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Boiler Circulation

Forced or Natural ?

WHATEVER the type of steam generator used in ordinary practice, its circulating system has in the past been based upon the convection principle, *i.e.*, the difference between the specific weights of steam and water. This difference decreases very rapidly as the steam pressure increases, and, largely on that account, attention was directed a few years ago towards the possibilities of forced circulation, an additional attraction of which was that the heating surfaces could be disposed so as to obtain the most efficient heat transfer.

At the same time, it was suggested that this method might be exploited to enable steam to be produced at the critical temperature, about 705 deg. F., corresponding to 3,200 lb. per sq. in., at which latent heat becomes zero. Forced circulation was then associated in the minds of most engineers with advanced steam conditions. More recently other advantages of forced circulation have become apparent, and, while the two Czech-type Loeffler boilers, which were put into commission this year at the Brimsdown " B " station of the North Met. Co., were designed for 1,900 lb. per sq. in., the La Mont boiler going in at Deptford West station of the London Power Co. will operate at only 375 lb.

Some of these advantages will be apparent from the article included in this issue on the 1,000-lb. per sq. in. La Mont boiler which Messrs. G. & J. Weir, Ltd., have installed recently at their Cathcart Works. As their chief object in doing so was to provide experimental data in connection with the special pumps and auxiliaries required for high-pressure work, it is evident that Weir's accept the inference to be drawn from the statement that more than 600 units of this type are in commission or under construction on the Continent.

Space Economy and Flexibility

Note should be taken of other claims that influenced their decision, viz., the greater output obtainable from the same space as compared with natural-circulation boilers, and a remarkable flexibility in meeting violent fluctuations in the steam demand. Also condensate is not available for feed water.

Comparison between the water-steam systems of the La Mont boiler, as illustrated in this week's article, and of the Loeffler boiler reveals several striking differences in design. In the latter, steam leaving the drum is pushed through radiant and convection superheaters; part then goes to the turbine, and the rest is injected into the water in the drum. In each case the quantity of water in circulation is much more than that of the steam, which facilitates separation of steam from the water.

A point of special interest in the Cathcart installation is the use of electric fusion welding in building up the drum, which has not, we believe, been done before in this country for pressures of the same order. The process, which was initiated in the United States about ten years ago, has been made practicable for pressures of the kind under consideration by advances in the technique of examining welded seams by means of X-rays. It is highly satisfactory to hear from John Thompson's that the production cost was lower than it would have been with forging.

Pressure Does Not Govern Choice

Judging by recent developments, it is evident that the sphere of forced-circulation boilers is not to be confined to ultra-high pressures. On the other hand, natural-circulation boilers have proved themselves eminently suitable for coping with the highest pressures yet used. They retain their pre-eminence in the United States, where, as Messrs. H. C. Lamb and K. Baumann reported in their recent I.M.E.A. paper, little or no progress has been made in the use of forced circulation. Thus, in the Twin Branch station in Indiana natural-circulation boilers will supply steam at 2,400 lb. per sq. in.

In Great Britain, where the practice has been to subordinate the pursuit of high pressures to the more immediately profitable achievement of high temperatures, the success of forced circulation is likely to depend upon what were at one time regarded as secondary advantages. Some inkling of the rivalry that may be expected between the two principles involved is to be found in the decision of the London Power Co. to install in the extended Battersea power station natural-circulation boilers with evaporative capacities of 500,000 lb. per hr. each with steam conditions of 1,350 lb. per sq. in. and 930 deg. F., and in its Deptford West station a forced-circulation boiler rated at 350,000 lb. (the largest La Mont boiler yet constructed anywhere) for the relatively moderate steam conditions of 375 lb. per sq. in. and 790 deg.

Rising prices of fuel make thermal efficiency in generation of greater urgency than ever, and a healthy rivalry between the two principles of circulating " stuff " will help in this direction.

Earthing to Water Mains

IN the current issue of the I.E.E. *Journal* are presented the draft regulations for controlling the earthing of electrical installations to metal water pipes which have been drawn up by the Institutions of Electrical and Civil Engineers and three other bodies representing the water interests. These regulations contain nothing that is opposed to recognised practice, so the view that the use of water mains in a legitimate way causes appreciable corrosion is presumably unfounded. In any case, the possibility of electrolytic effects should be reduced with the tendency to change from d.c. to a.c. distribution, although the question of whether a.c. leakage currents may not be partly rectified in underground water supply systems still awaits solution. This, among other matters, is being investigated by the Electrical Research Association, and the proposed regulations may be amended as a result of further experience.

Organising Electrical Retailers

THIS week the National Association of Electrical Retailers commenced its membership "drive." A very large number of electrical retailers (not all dealing exclusively in electrical goods) is being approached by means of a booklet setting out the objects of the Association. Fuller reference is made to this on page 459. The qualifications for membership are not extraordinarily high. For instance, the possibility of the candidate's trading from a private house is envisaged in the application form. Each case, it is stated, is judged on its merits and "the interests of the small man are not overlooked." The applicant is asked to "state average value of electrical stock permanently held"—it is the value, not the stock, which is permanent, of course. This implies that there is a stock qualification, which is very necessary. The applicant undertakes to maintain manufacturers' list prices for all the goods which he sells which is in line with the Fair Trading Policy to which the N.A.E.R., through the N.E.C.T.A. subscribes.

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Adverse Publicity

IN this issue we mention the case of a claim brought against a consumer by an electricity supply company. The consumer wanted a certain make of cooker, but as this could not be supplied immediately he was given another one temporarily. This proved unsatisfactory and the company removed it, but instead of installing the cooker which was wanted brought an action to recover a year's rental. The judge held that the company had failed to carry out its contract and dismissed the claim with costs. We cannot help thinking that the company's move was very unwise and likely to do it damage. "The customer is always right" is not a tenet to be adhered to in any circumstances but in this instance it seems that the customer had a grievance which might have been settled without legal proceedings and the consequent adverse publicity in a fairly widely circulated newspaper.

The 1939 I.M.E.A. Convention

IT is announced that next year's convention of the Incorporated Municipal Electrical Association is to be held at Llandudno from June 5th to 10th, under the presidency of Mr. H. C. Lamb, chief engineer and manager of the Manchester Corporation undertaking. Many readers will be disappointed to hear that it is proposed not to organise the usual exhibition. There are reasons for this, of course, but we are assured that it does not mean the discontinuance of these valuable annual displays. It is not easy to find suitable accommodation in Llandudno, and there has been a feeling among manufacturers that a break would do no harm; they would probably be satisfied with an exhibition every two years. The I.M.E.A. is prepared to give every support and encouragement to manufacturers who would like to stage a display on their own responsibility. While we do not feel entirely happy about the suspension of the exhibition, we think that possibly delegates will welcome the next one more enthusiastically. At some previous conventions the exhibition has been looked upon rather as a side-show instead of an unrivalled opportunity of inspecting and comparing the latest domestic electrical developments.

Sir Philip Dawson

BY the death of Sir Philip Dawson the electrical industry has lost not only a leading pioneer of railway electrification in this country but also its stalwart champion throughout his life. How much he had the subject at heart right up to the end was evident from some correspondence we had with him not more than six months ago. He missed no opportunity either in Parliament or in the Press of pointing out how many of the deficiencies in our railway system, particularly round large towns, could be cured by electrical means; yet his suggestions were always well within practicable bounds. We have always been glad to recall, on his own authority, that the first article of his to be published as a young man appeared in the ELECTRICAL REVIEW. A notable contribution to our pages of more recent times was the critical review he did for us of the Weir Report on main line electrification. We have no doubt that his constructive proposals will be proved ultimately to have left their impress on the minds of all who are interested in the welfare of our railways and their ultimate electrification.

Maintaining a Balance

SOMETHING of a storm in a teacup has been aroused at Southend-on-Sea by the recent statement of the borough electrical engineer (Mr. A. C. Johnson) that a small deficit is likely to result from the current year's operations of his department. The Council immediately issued a fiat calling for the balancing of the accounts. Mr. Johnson has had to explain that a deficit on a municipally-owned undertaking is not always so serious as it looks and is in this case caused by adherence to the financial rules governing such an undertaking, which differ considerably from company accountancy, and to the expenditure of income for capital purposes. Nevertheless, to appease those who see ruin staring the undertaking in the face, he reluctantly puts forward a number of tariff revisions which will produce the balance on the right side which the councillors are anxious to see.

Special Domestic Issue

ALTHOUGH the seriousness of the political situation at the present moment has caused a number of arrangements to be cancelled it is not proposed to abandon the publication next week of the annual Special Domestic Issue of the ELECTRICAL REVIEW. This issue will contain details of the latest equipment for lighting, heating, cooking and many other services that can be performed electrically in the home, together with a number of signed articles surveying different aspects of the subject.

High-pressure Boiler Plant

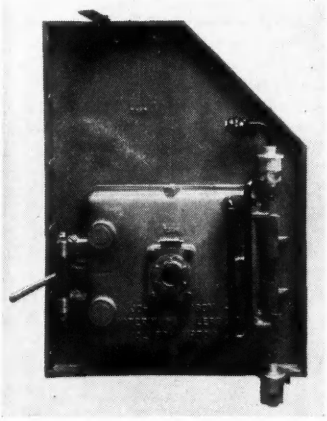
New La Mont installation

WITH a view primarily to obtaining supplies of high-pressure steam for testing the power-plant auxiliaries built at Cathcart, Glasgow, G. & J. Weir, Ltd., have recently installed a La Mont forced-circulation boiler unit with an evaporative capacity of 50,000 lb. per hr. (m.c.r.) operating at 1,000 lb. per sq. in. and 850 deg. F.

Reasons for the choice of this type included the need for a high degree of flexibility in meeting widely varying demands for steam, the use of nearly 100 per cent. feed make up and the impracticability of accommodating a normal boiler of more than 16,000 lb. per hr. capacity in the space available.

The compact construction of the boiler is shown by the following principal dimensions: Width, 12 ft.; depth from front to back, 26 ft. 9 in.; height from firing floor to underside of roof trusses, 31 ft. 9 in. This space provides a heating surface of 3,050 sq. ft. for boiler and water walls, 5,380 sq. ft. for the economiser and 1,250 sq. ft. for the superheater.

In the La Mont boiler, circulation is maintained by a pump with a pressure differential of 35 lb. per sq. in. through tubes of small diameter and high fluid velocities, which are arranged with heat absorption and not circulation in view. All tubes deal with an amount of water that is proportionate to their heat-absorbing capacity, as determined by their position, by means of metering nozzles of various sizes at the entrances. The boiler circulation system is indicated in the flow diagram reproduced.

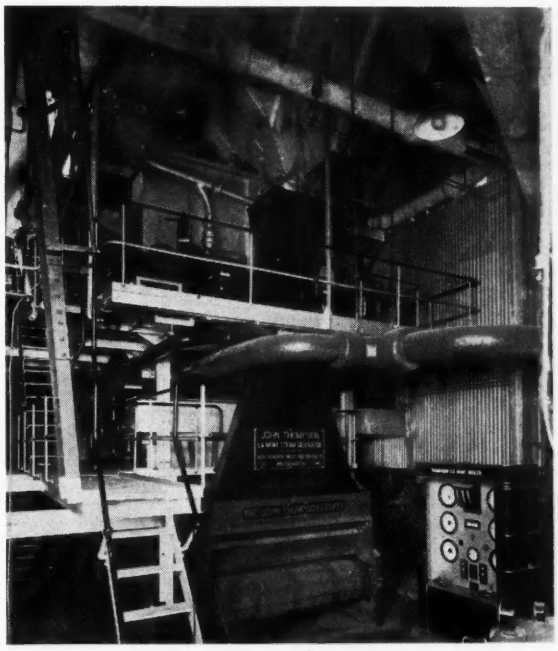


Water-cooled furnace access door

Fusion welding has been adopted throughout the boiler. The drum, which is 15 ft. 5 in. overall in length, 3 ft. 3 in. in internal diameter and 2¼ in. thick, weighs 8½ tons. Fabrication was carried out by John Thompsons. Economy in weld metal (of which about 2 cwt. was deposited) was secured by planing the joint edges, giving an almost parallel-side "U" groove on assembly; this method also assisted X-ray examination, since any lack of side-wall fusion would be concentrated in the plane of the rays. Each run of metal deposited was continued beyond the seam on to a 2 ft. long test piece. After welding the entire vessel was slowly heated to 620 deg. C. All-welded construction has also been employed for the high-pressure steam mains in conjunction with Dawson flangeless joints.

Heating surfaces throughout are composed of 1¼ in. o.d. bent mild-steel tubes welded together. The combustion chamber is 80 per cent. lined with closely pitched tubes unprotected by blocks but backed by tiles and insulation. The furnace door is cooled by water circulation and has no refractory facing. No air preheater is provided, but even with high-volatile Scotch coal it is reported that smoke is absent at all loads and a heat energy release of 36,000 B.th.u. per cu. ft. is obtained at the normal economical ruling of 40,000 lb. per hour, whilst the balanced-draught stoker burns upwards of 40 lb. of coal per sq. ft. per hour at m.c.r.

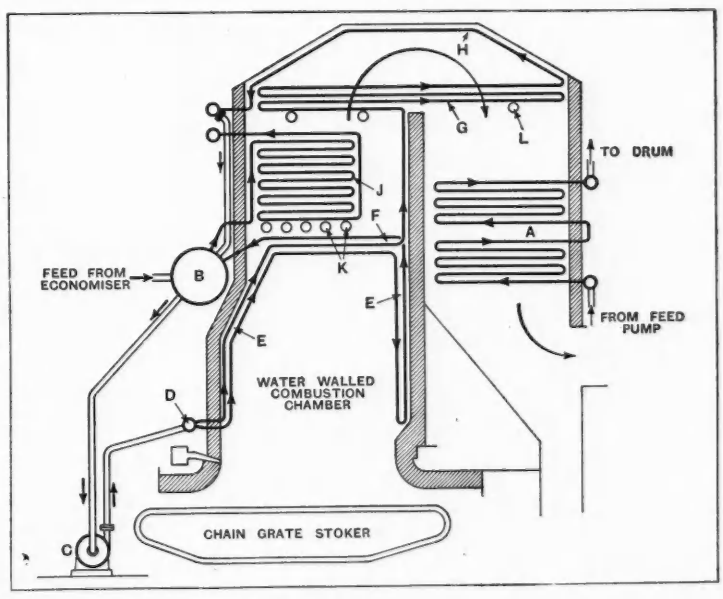
A "MeLesCo" superheater of orthodox design is situated above the first evaporator section. Steam temperature control is by means of a John Thompson "inert gas recirculation system"—the first in commercial use—in which a proportion of the gases discharged from the induced-draught fan is reintroduced into the main circuit immediately before the superheater, thus lowering the temperature of the furnace gas as required, also obviating the need for a damper operating at high temperatures for controlling the furnace gases through the superheater.



General view of the boiler

An economiser, of the bent-tube type, is set integrally in the boiler setting. This raises the temperature of the fuel to 216 deg. F. at n.e.r. When the gas leaving the economiser is at 330 deg. F. a CO_2 percentage of 12.5 is obtained. "Diamond" soot blowers are employed, of the gun type for the combustion chamber and jet type for the other parts of the boiler as well as for the superheater and economiser; for these steam is taken at 350 lb. per sq. in from the medium-pressure mains.

Duplicate constant-speed centrifugal circulating pumps are provided, one electric and one steam, as stand-by, with a throughput six to eight times the evaporative capacity of the boiler. Pressures are 1,000 lb. per sq. in. at the suction and 1,035 lb. at the delivery. The barrel is a steel forging, suction and discharge branches being machined from the solid metal. The Monel metal impeller is of the single-stage double-inlet balanced type. Sleeves of stainless steel surround the shaft and protect the water-jacketed glands from full working pressure. For driving the stand-by pump a turbine with one



Simplified flow diagram

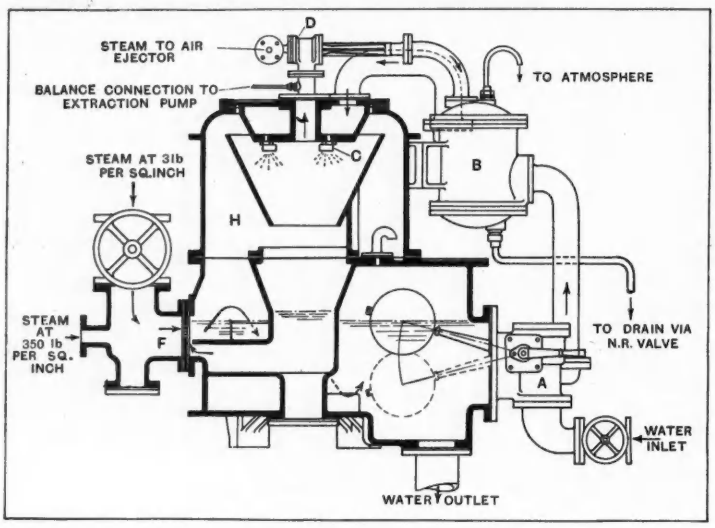
A. Economiser. B. Steam and water drum. C. Circulating pump. D. Distributing header. E. First evaporator, radiant heat section. F. First evaporator, convection section. G. Second evaporator. H. Roof tubes. J. Superheater. K. Inert gas recirculating tubes. L. Water-cooled tube supports.

pressure and three velocity stages is used. This unit cuts in automatically in the event of failure of the electric pump by a diaphragm-operated switch in circuit with an electro-hydraulic thrustor connected to the throttle and actuated by the difference between the suction and discharge pressures.

Waste gases of combustion are dealt with by a new 90-ft. self-supporting mild steel chimney, 5 ft. in diameter at the top. The induced-draught fan, 58 in. in diameter, is driven by a two-speed motor at 580 and 725 r.p.m., taking 25 and 44 h.p. and having corresponding duties of 30,000 and 40,000 cu. ft. per min. and w.g. pressures of 3.5 and 4 in. For operating the 50½-in. forced-draught fan at the same speeds, 8.8 and 15.7 h.p. is required to provide 17,000 and 21,000 cu. ft. per min. at 2.25 and 3.0 in. w.g. Regulation of the draught is effected from the boiler control panel by altering the inclination of the stationary fan guide blades. Secondary air, which is admitted to the combustion chamber through the inclined front arch, is supplied by a 24½ in. 1,440 r.p.m. fan with a capacity of 5,000 cu. ft. per min. at 5.75 in. w.g.

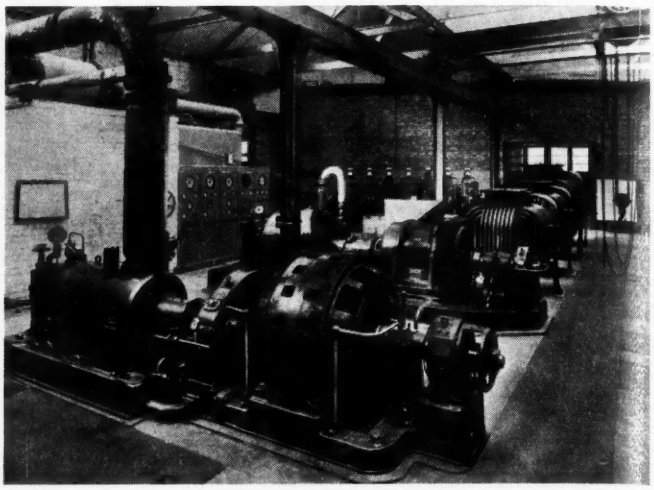
The turbo-generators

The chain-grate stoker, 9 ft. wide by 16 ft. long, is fitted with serrated links and is driven through an eight-speed gear box. Ashes are discharged to a submerged 36-in. belt conveyor, gear-driven by a totally enclosed 3-h.p. motor, and are taken to an elevator and finally discharged to a 10-ton concrete-lined overhead bunker by a 5-cwt. automatic hoist.



Section through Weir feed-water de-aerator

A. Float-operated valve. B. De-vaporiser. C. Spray nozzles. D. Single-stage air ejector. F. Perforated distribution plate.

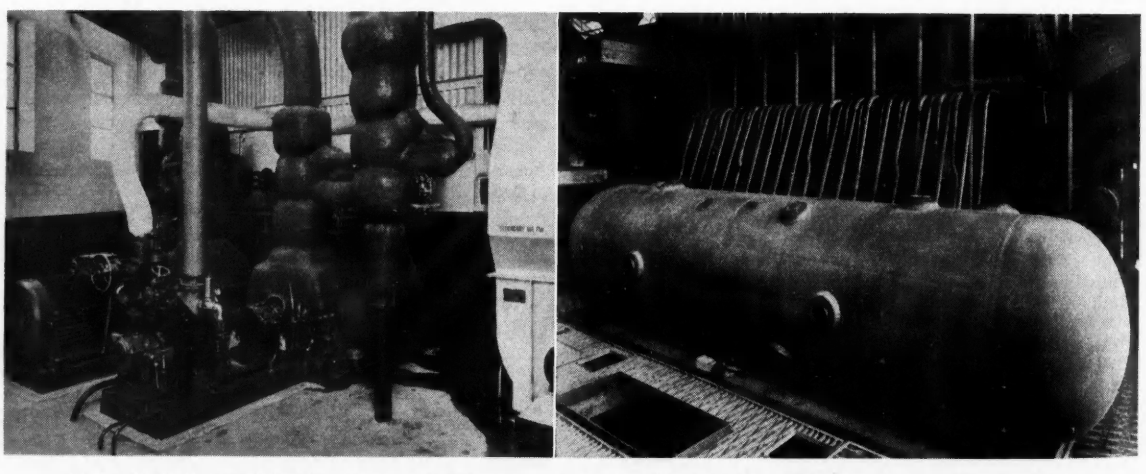


within 1 in. and the steam temperature and pressure being little affected. A figure of 83.36 per cent. gross overall thermal efficiency has, we are informed, been obtained (as against 81 per cent. estimated) and 82.92 per cent. allowing for the auxiliaries, while steam was produced at the rate of 8.01 lb. per lb. of coal.

In addition to the testing requirements, h.p. steam is employed for factory heating and for electric power. For this purpose a 700-kW turbo-alternator has been installed; the 8,000-r.p.m. turbine (designed for 1,000 lb. per sq. in.) takes steam at 850 lb. and 850 deg. F. and drives through single-reduction double-helical gearing a 1,500-r.p.m. generator. The turbine exhausts to an existing 350-lb. per sq. in. system for testing and shop services, which can also be supplied direct from the La Mont boiler through an "Arca" reducing valve and de-superheater.

An intermediate-pressure 6,000-r.p.m. turbine takes steam at 350 lb. for driving a 600-kVA alternator through similar gearing at 1,000 r.p.m. and exhausts at 3 lb. per sq. in. back pressure. This steam is sent to the heating system and also to a 500-kW, 3,000-r.p.m. turbo-alternator with jet condenser (vac. 28 in. Hg). Water for the condenser and for pumping tests are taken from the River Cart by separate pipe lines, but both have a common intake with a Brackett central-flow self-cleaning screen capable of dealing with 200,000 gal. per hour and gear-driven by a two-speed motor.

Feed water is taken from the town main and first passes through the coolers of the two-stage steam-jet air ejector which evacuates the main condenser, whence it goes through the water jackets of shop auxiliaries and air com-



Weir electrically and turbine driven circulating pumps for La Mont boiler and (right) steam and water drum

Preliminary experience with the boiler has shown that load surges from 8,000 up to 38,000 lb. of steam per hour in one minute can be met without difficulty, the water level remaining

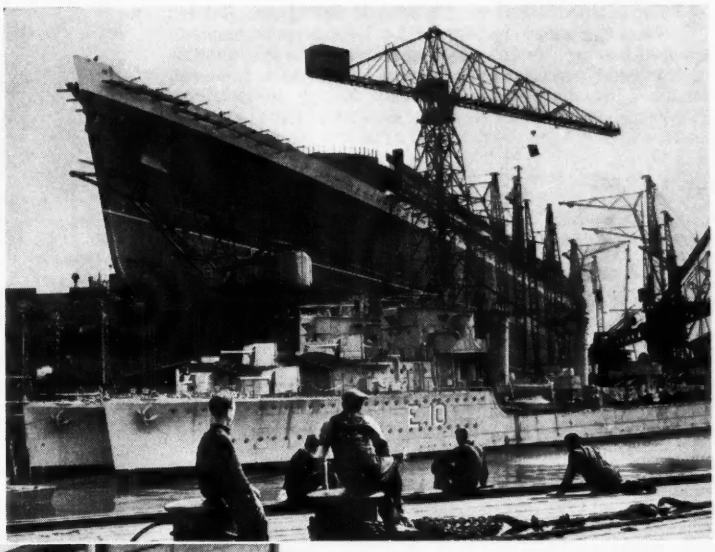
pressors. It then enters a Kennicott chemical softening plant, where it is treated with sodium carbonate, sodium sulphate and sodium phosphate before being led to the feed tank, which

The "Queen Elizabeth"

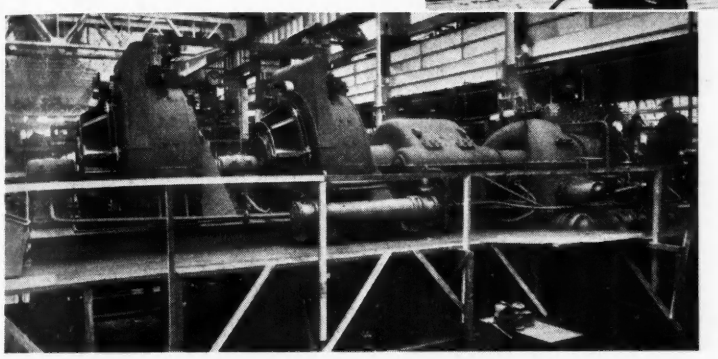
Launching by Her Majesty

ON Tuesday Her Majesty the Queen launched the 85,000-ton Cunard White-Star liner *Queen Elizabeth*, 1,031 ft. long by 118 ft. beam, the heaviest launching weight and largest hull ever sent into the water.

Four screws propel the vessel, requiring a s.h.p. of 220,000 h.p., which is provided by Parsons turbines supplied with steam from twelve Yarrow boilers working at 425 lb. per sq. in. and 750 deg. F. The stokeholds will not be closed as they are on the *Queen Mary* and each boiler has its forced-draught fan.



The "Queen Elizabeth," showing (right) the hull and (below) the B.T.H. turbines for the hotel services



Electricity for the hotel services will be supplied by four twelve-stage 4,500-r.p.m. turbines operating with steam at 390 lb. per sq. in. and 730 deg. F. and driving through reduction gearing 2,200-kW 225-V 600-r.p.m. d.c. generators. The condensers are integral with the turbines. These sets, which are larger than those built for the *Queen Mary* by the same company, were manufactured by the British Thomson-Houston Co., Ltd., which is also supplying a considerable number of motors with their control gear, including twenty of 20 h.p. at 520 r.p.m. for lifeboat winches. Several thousand "Mazda" lamps in decorative fittings are to be installed.

The B.T.H. Co. will also supply through Henry Wilson & Co., Ltd., "Torribar" heating elements for the kitchens.

Laurence, Scott & Electromotors, Ltd., are supplying motors of an aggregate h.p. approaching 20,000. This represents practically a repetition of the order for the *Queen Mary* with the addition of the cargo winches. Some of the latter are of the "reducer" type, giving a high degree of flexibility in regard to control of speed. The range extends from a ¾ h.p. motor driving a small pump to the twelve 358-h.p. motors for the forced-draught fans, and includes a number of two-speed machines. Among the larger L.S.E. motors are three of 250 h.p. running at 400 r.p.m., which drive the rotary pumps used to supply oil to the ram cylinders of the hydraulic steering gear. Duplicate 4-h.p. servo-motors with telemotor control drive the pumps supplying oil to the valves. The elaborate motor control system for the steering gear was manufactured by Brookhirst Switchgear, Ltd. (see illustration on page 460), which also provided panels for the associated meters and signals. The equipment on each of the three motor panels comprises a solenoid automatic controller with eddy-drag retarder, which operates electro-magnetic contactors successively to cut out starting resistance; a final contactor (double-pole); an isolating knife switch; indicating lamp and secondary-circuit fuses. The servo-motors take alternative supplies from either port or starboard machinery boards and each motor comprises an automatic solenoid starter.

Approximately 615 miles of rubber insulated cables (nearly all single-core) are being supplied by W. T. Henley's Telegraph Works Co., Ltd. They are all of the C.M.A. grade for 250 V and 660 V, and those without fire-resisting finish will probably be enclosed in steel casing or conduits by the builders of the vessel, John Brown & Co., Ltd., who are carrying out the installation work.

Staterooms and cabins will be heated by Thermovents (originally developed to avoid fire risks on the *Queen Mary*). About 600 units are to be supplied by E. K. Cole, Ltd. Another virtually repeat order is reported by Clifford & Snell (Eng.), Ltd., who are providing "Loudaphones" for communicating between the great number of control positions and "Loudasound" boat-deck equipment to enable a voice from the bridge to be heard at every lifeboat position.

Improvements in details, based upon experience with the earlier vessel, are to be embodied in the radio installation, to be supplied and operated by the International Marine Radio Co., Ltd., which informs us that passengers will be able to speak from their cabins to telephone subscribers in any part of the world with complete privacy. A special pneumatic conveyor system will take radiograms to the control room. Multiphase working for receiving and transmitting on short-, medium- and long-wave is being adopted. Two lifeboats will carry B.O.T. radio installations and in addition a simply operated radio-telephone set.

High-pressure Boiler Plant (*Continued from preceding page*)

also receives the steam drains from the factory heating system.

Water from the feed tank is sprayed into the shell of an "Optimum" de-aerator, where it comes in contact with the vapour of the exhaust steam (normally at 3 lb. per sq. in.), while under the influence of the vacuum created by the ejector and its temperature is raised and it is partly de-aerated. Falling into the central lower compartment the water meets the incoming steam and boils rapidly; air in solution is driven off and the de-aerated water flows over a weir, at a level where the ebullition is most violent, into a compartment from which it is withdrawn by means of a motor-driven extractor pump and delivered to the suction of vertical direct-acting Simplex feed pumps taking steam at 350 lb. per sq. in. Daily tests have produced oxygen readings varying from 0.04 cu. cm. per litre to zero.

The La Mont boiler unit was made by John Thompson Water Tube Boilers, Ltd., who also provided the chain-grate stoker, chimney and ash-handling plant. G. & J. Weir, Ltd., themselves supplied the electric and turbine-driven circulating pumps, feed pumps and their stainless-steel suction and discharge valves and the de-aerator. Other principal manufacturers were Bellis & Morcom, Ltd., main turbines and alternators for high- and medium-pressure sets; Electroflo Meters Co., Ltd., instrument panel for boiler house and a five-panel instrument board for the turbines, condenser and feed system; E. Green & Son, Ltd., economiser; Hopkinsons, Ltd., boiler valves and mountings; James Howden & Co., Ltd., forced and induced-draught and secondary-air fans; Stewarts & Lloyds, Ltd., steam mains and 10-in. pipe line with spun bituminous lining for condensing water; Superheater Co., Ltd., superheater; Siemens Bros. & Co., Ltd., alternator for the low-pressure set.

On-load Tap Changing

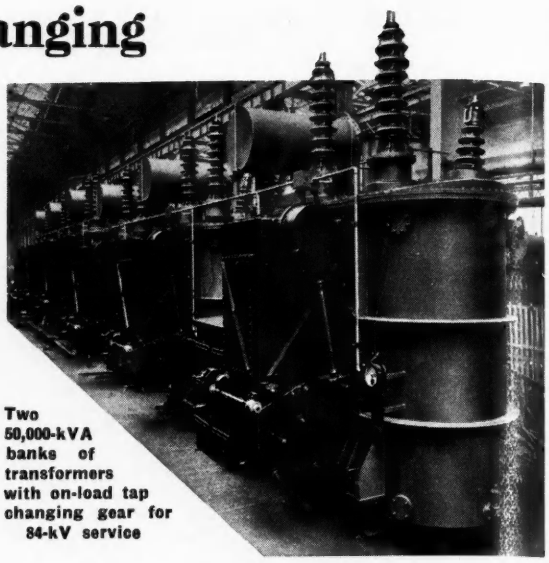
By R. M. Charley, M.C., B.Sc., M.I.E.E.

Transformers for high-voltage operation

THE art of building transformers with on-load tap-changing equipment has been developed during the past ten years and about eighteen million kVA of transformers so equipped has been supplied by manufacturers in this country. Of this total capacity about eleven million kVA has been purchased by the Central Electricity Board, seven million kVA being for service at 132 kV in sizes up to 75,000 kVA and about four million kVA for service at 66 kV or lower voltages in sizes up to 45,000 kVA.

The 132-kV transformers are connected to the grid which operates on the solidly grounded neutral principle; the neutral on the higher-voltage side of each transformer is solidly connected to the core and the insulation from the winding to ground is graded from a maximum at the line end to a minimum at the grounded end. Transformers so designed are tested in accordance with B.S.S. 171/1936, Table 9 (2). The applied-voltage test (A) is 45 kV and its purpose is to test the neutral end of the winding, the ground connection, of course, being removed. The main insulation test is the induced-voltage test (B) and for the 132-kV transformers on the grid the test voltage is 2.73×132 kV $= 360$ kV across the high-voltage line terminals, the neutral being connected solidly to the core.

Thus the test voltage above earth of each point of the 132-kV winding varies proportionately through the winding from $360/\sqrt{3} = 208$ kV at the line end to zero at the grounded end. The tappings are located near the neutral end of the windings, and hence, with a tapping range of 20 per cent., the maximum voltage of the on-load tap-changing equipment above earth is approximately 19 kV under service conditions or 52 kV under test conditions. Therefore the tap-changing gear of 132-kV transformers ranks in a comparatively low-voltage class.

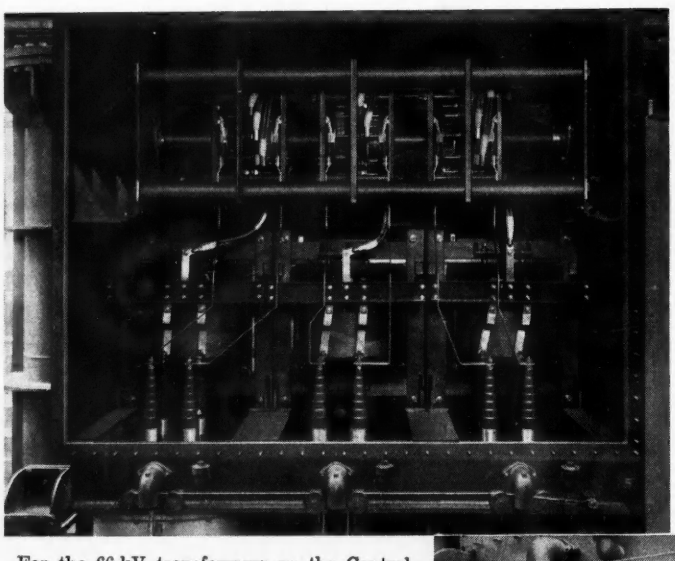


Two 50,000-kVA banks of transformers with on-load tap changing gear for 84-kV service

is actuated by means of a Geneva motion from motor operating gear outside the chamber; the mid-point auto-transformers are situated in the same chamber, but the divertor switches are mounted below this chamber a separate tank being provided for each phase; these tanks are arranged for convenient and speedy lowering to facilitate inspection and maintenance of the contracts.

An example that probably constitutes the highest voltage class on-load tap-changing gear achieved in this country is a single-phase unit for use on a 55,000-kVA three-phase bank at a voltage of 84 kV; the tapping range is twenty-six per cent. and the applied-voltage test (A) is 180 kV. The on-load tap-changing gear is generally similar to that for 66-kV service referred to above, but the mid-point auto-transformer is situated in the main transformer tank.

Three units are coupled together by a shaft actuated by a single motor operating gear mounted on the ground between two units. Nine duplicate banks of these have been installed in the system of the Victoria Falls and Transvaal Power Company, Ltd.



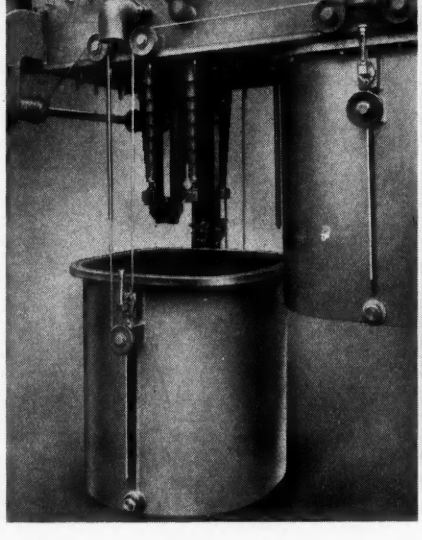
On-load tap-changing gear for 66-kV service, tested at 133 kV

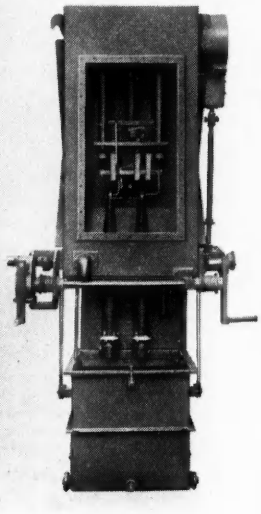
This achievement marks a record in the construction of transformer on-load tap-changing equipment in this country, but, by no means does it indicate a limit, and manufacturers are prepared to build such transformers for operation on much higher voltages.

Acknowledgments are due to the English Electric Co., Ltd., for the use of the photographs illustrating this article.

For the 66-kV transformers on the Central Electricity Board's systems, the higher-voltage winding is star connected with the neutral earthed through a resistance or solidly. The insulation test applied to the complete transformer is such that the voltage of the on-load tap-changing equipment above earth is 102 kV.

Many other 66-kV transformers have been built in which the on-load tap-changing gear is included in the applied-voltage test of 133 kV in accordance with B.S.S. 171/1936 Table 9 (1). It is fitted to a 40,000 kVA transformer and the tapping range is 30 per cent. in fourteen steps.





Left: Divertor switches for gear illustrated above. Right: On-load tap-changing gear for 84-kV service, tested at 180 kV

The whole equipment is mounted outside the main transformer tank: the three-phase selector switch is mounted horizontally and

The Iodine Accumulator

By C. M. R. Balbi, M.I.E.E., A.C.G.I., and R. S. H. Boulding, O.B.E., B.Sc., A.M.I.E.E.

Theory and applications

ALTHOUGH the idea of the iodine accumulator is by no means a new one—the earliest patents on the subject were taken out some fifty years ago—and in spite of the simplicity of the fundamental principles involved, it is only within the last few years that it has been found possible to construct an iodine accumulator which is a practical success.

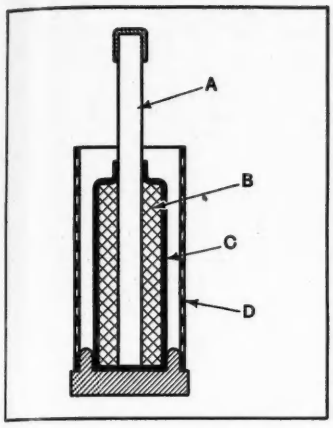
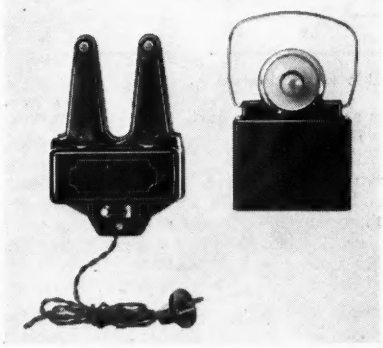


Fig. 1.—Schematic assembly of iodine accumulator. A. Central carbon rod. B. Anode. C. Fabric covering. D. Perforated zinc cathode

The fundamental theory is extremely simple, the accumulator consisting, in essence, of electrodes of carbon and zinc in an electrolyte composed of a solution of zinc iodide. On charging, the following reaction takes place:—$ZnI_2 = Zn + I_2$. The zinc is deposited on the zinc cathode, and the iodine on the carbon anode. On discharge, the reverse process takes place, the zinc and iodine recombining to form zinc iodide:—$Zn+I_2=ZnI_2$.

In theory, therefore, the process is completely reversible, and should give 100 per cent. efficiency on an ampere-hour basis. Furthermore, there are no secondary reactions to complicate the process, as in the lead accumulator, where the primary reaction is the decomposition of sulphuric acid. Gases are not evolved, and nothing is lost. The battery can be made in liquid form, but the type under discussion is "dry." If any approach to perfect, or even satisfactory, working is to be obtained the products of decomposition of the electrolyte, namely, zinc and iodine, must not be lost, but must be retained adhering closely to their respective electrodes. There is no particular difficulty about getting the zinc to adhere to the zinc cathode; this is simply ordinary electro plating, but there is no very obvious reason why the iodine should adhere satisfactorily to the carbon anode; and it must not be forgotten that any iodine that does not so adhere is lost, so far as any useful function in the cell is concerned.

Handlamp and charging unit



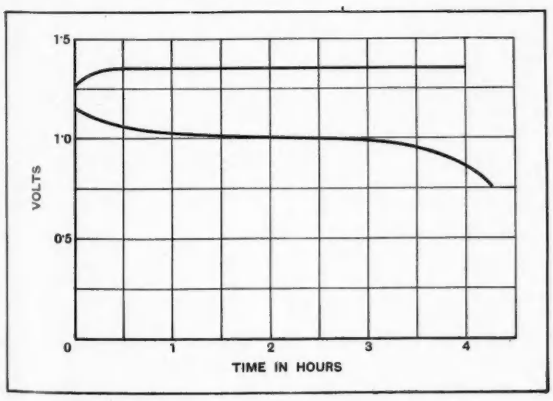


Fig. 2.—Charge and discharge curves

The provision of a layer of porous carbon round the electrode itself has been found highly beneficial because, in addition to providing increased surface, it enables the iodine to be retained far more satisfactorily, an action which is further assisted by binding up the mass with a sheet of suitable fabric. To make the maximum use of the available material the anode should be made in a cylindrical form, as above described, and the cathode should be in the form of a hollow cylinder concentric with the anode.

Test gear with self-contained charging unit

An assembly as described would naturally be porous and allow the electrolyte to creep up to the terminals, with consequent detriment to the latter. This difficulty has been successfully overcome by impregnating the carbon rod with wax or some synthetic resin.

To offset the increase of resistance resulting from this impregnation and to assist in ensuring even distribution of current, it has been found advantageous to provide a copper wire core for the central carbon rod in the anode assembly.

As regards the cathode, there is no difficulty in making a zinc cylinder as described, but it has been found better in practice to make the cathode of iron heavily zinc plated. Such an assembly is shown diagrammatically in fig. 1.

The electrolyte consists principally of a solution of zinc

TABULATED COMPARISON BETWEEN LEAD, NICKEL CADMIUM AND IODINE ACCUMULATORS.

	Lead	Cadmium-Nickel	Iodine
Watt-hours per pound when discharged at			
10 hr. rate	For new batteries	Approximately	For immediate discharge
Ditto, 5 hr. rate ...	5–10	8	10–12
Ditto, 3 hr. rate ...	4– 9	7	10–12
	Maximum 7	6	9
Watt-hours per cu. ft. when discharged at			
the 5 hr. rate ...	500–1500	Approximately 600	800–1100
Ditto, 3 hr. rate ...	Maximum 1200	450	700– 800
Watt-hour efficiency, normal charge, discharge at 10 hr. rate	Approx. average for new batteries 70%	50%	75%
Discharge at 5 hr. rate	60%	50%	70%
Loss of charge when not in use.	Average about 1% per day.	Small.	About 1% per day.
Construction, adaptability, etc.	Metal (other than lead) cannot be used for containers. Difficult to keep clean. Not readily adaptable.	Liable to external sweating. Steel containers. More adaptable than the lead battery	Metal containers practicable. Very clean. Very adaptable.
Evolution of gases ...	Important.	Important.	Negligible rendering almost complete enclosure practicable.
Supervision	Periodical attention must be given to electrolyte. Must be charged about every two months when not in use.	Periodical supervision required. Electrolyte inclined to absorb carbon dioxide forming carbonate.	None required.
Risk of deterioration...	Considerable.	Small.	Small, apart from damage caused if accidentally charged in reverse direction.
Life	Dependent upon conditions of use. New plates (or new cells) generally required after about 300 charges.	Should last for about 1,000 charges.	Good for about 300 charges without appreciable loss of capacity.

iodide, of specific gravity 1.4 to 1.5, but to improve the working certain other salts of zinc and of aluminium are also added in definite proportions.

The container may be made of glass or bakelite or any other convenient insulating material. Well-enamelled sheet steel is quite satisfactory, as also is bakelised aluminium. Owing to the virtual non-existence of evolved gas, the container may be made practically airtight.

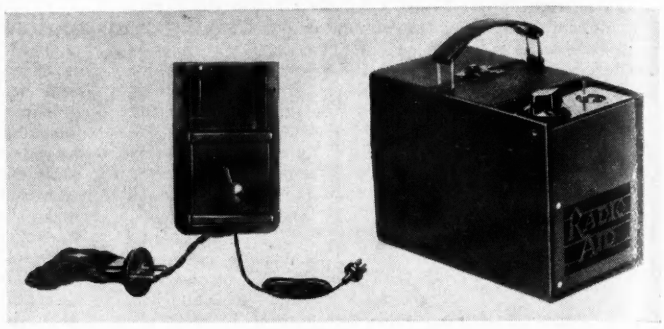
An ampere-hour efficiency of from 80 to something like 95 per cent. is claimed, the higher efficiency being obtained on a slow discharge. The corresponding figures for watt-hour efficiency are 65-70 per cent. The voltage on discharge is approximately 1 V per cell, and is fairly constant over the period of discharge. The actual variation is about double that of a lead accumulator, but only about half that experienced with a normal dry battery. These results are illustrated graphically by the charge and discharge curves shown in fig. 2.

A capacity of 10-12 watt-hours per pound is stated to be obtainable, a figure which compares not unfavourably with that applicable to the alkaline accumulator, and which is very much better than that for the ordinary lead-acid battery.

The loss of charge while standing idle is comparable to that for a lead battery, namely, about 1 per cent. per day, but the iodine accumulator possesses the great advantage, which it shares with the alkaline type, of not suffering any damage when left in an uncharged condition for any length of time.

The cell can be recharged some 300 times before it becomes so deteriorated as to render further charging unprofitable. Evolution of gas is negligible while the cell is new, only becoming appreciable after some 80-90 charges and discharges, but even then it is by no means excessive provided the cells are not overcharged.

Deaf aid with enclosed batteries and charger



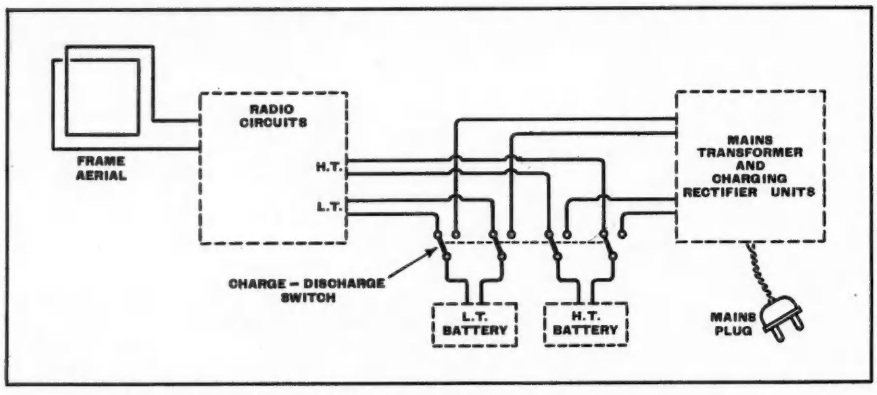


Fig. 3.—Schematic circuit showing application to portable radio receiver

Uses of Accumulator

From what has been said it will be realised that the iodine accumulator possesses all the advantages of portability, cleanliness, &c., of the dry battery. True, its voltage is somewhat lower to begin with, but this is easily compensated for by its improved constancy, as compared with the dry cell. Above all, the iodine accumulator possesses the very great advantage that it is a true accumulator and can be recharged time and time again. Although its first cost is considerably higher than that of a dry cell of equivalent capacity, this cost is small compared with the cost of 300 or even 100 dry batteries.

The absence of acid renders the accumulator much safer to use in portable apparatus than the lead battery, an advantage by no means negligible, as all who have used portable accumulators will readily appreciate. It is the only accumulator that can be worn with safety.

Some Examples of Possible Use

Handlamps, Torches, &c.—Iodine accumulators may replace the usual dry battery in these. A simple trickle charger can be supplied in the form of a stand or bracket on which the lamp can be placed when not in use. By providing suitable sockets on the lamp, as shown in the illustration, and corresponding pins on the charger, the act of charging the battery after a period of use resolves itself merely into one of replacing the lamp on its normal resting place when not in use. It would be difficult to imagine anything much simpler.

Test Apparatus.—Another application of the iodine accumulator is in connection with test apparatus where the advantages of "all-mains drive" are desired without the troubles due to mains interference, complicated smoothing circuits, &c. In such cases the charging circuit is conveniently incorporated in the apparatus itself, which is simply provided with a plug at the end of a flexible cord for insertion into any available socket when charging is required. An audiometer, used for testing the hearing loss of deaf persons, fitted up in this way, is illustrated. In cases where size and weight are of great importance, the charging unit can, of course, be made separately.

Portable Wireless Sets.—This is another excellent example of how an iodine accumulator can be used to advantage. The benefit of not having to remove the accumulator at frequent intervals will be appreciated by those who have suffered, to say nothing of the disappointment resulting from a battery which is found to be run down just when it is wanted, due to recharging having been delayed owing to the trouble involved. This arrangement is shown in schematic form in fig. 3.

Deaf Aids.—Another very useful application is in connection with portable deaf aids of the valve amplifier type. The set can be used all day, plugged into its charging unit at night, and be found ready for use in the morning—a great boon to those who have to use these instruments constantly, and also a great financial saving compared with the cost of constantly purchasing new dry batteries.

New Standard Specifications

Welding Electrode Holders.—The different forms of electrode holder that have been adopted by various makers of welding machines has hampered the rapidity with which a change-over can be made from one machine to another in the case of failure of one of them. To avoid this limitation B.S.S. No. 807 has been issued for shanks of electrodes for spot welding machines. It specifies the form and dimensions of the hole in the electrode holder and of the shank of the electrode which fits into this hole. In the case of heavy pressure machines it is desirable to reverse this method of attachment and provide the arm of the machine with a spigot which fits into a hole in the electrode. In such cases the form and dimensions of the spigot and hole should be the same as in this specification.

Carbon Brushes.—To the British Standard Specification for parallel-sided carbon brushes, issued in August, has been added a range of brushes for commutators of fractional horse-power motors; also a section providing a range of brushes for use on slip-rings. The inclusion of additional sizes has made it necessary to alter the identification numbers of the brushes included in the 1922 edition, and in order to avoid confusion a new system of numbering has been adopted. This specification applies to carbon, graphite and metal-graphite brushes for both a.c. and d.c. machines.

Train-lighting Batteries.—A revision of the specification for lead-acid train-lighting accumulators (Planté and Faure types) is announced, in which the subject matter has been rearranged and amplified where experience has shown this to be desirable. In particular the conditions under which acceptance tests are to be carried out have been revised. A schedule of particulars to be completed by the manufacturer when tendering, and an appendix specifying the method of determining the internal resistance, when specially called for, have been added.

Copies of these specifications (Nos. 807-1938, 96-1938 and 454-1938 respectively) may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Trolley-bus Overhead Systems. By H. C. Harris, A.M.I.E.E.

Notes on design and construction

WHEN laying out the distribution scheme for a trolley-bus system the first requirement is to decide where each section of trolley wire shall begin and end. The length of the section is determined by the load and the resistance. For modern schemes 4/0 cadmium-copper grooved trolley wire, with a resistance of 0.215 ohm per 1,000 yd., is generally employed, and therefore the most economical length of section can easily be calculated when the number of buses per hour is known. Most two-decker trolley-buses take about 250 to 300 A at 600 V for starting, and the average consumption when a number of buses is running is about 50 A each.

The curves in fig. 1 show approximately how the voltage drop in the trolley wires varies with the number of trolley-buses, when using various lengths of section. In all calculations ample allowance should be made for traffic congestion, which may be considerable in towns where there are many busy road junctions. In such cases it is not too much to multiply the calculated voltage drop by a congestion factor of 3 or 4. A Ministry of Transport regulation fixes the maximum length of a section at half a mile (unless special exemption is obtained) to facilitate switching operations in event of trouble.

Where possible, the limits should be located so that any junctions are at the end of the section, as this keeps the number of section insulators and switching pillars down to the minimum, thus making a neater and cheaper job, reducing maintenance and simplifying switching.

Feeding Points

It is often worth while to feed complicated junctions separately. This is especially the case where traffic signals exist, because in such circumstances it is becoming the practice to put the leading frogs back a considerable distance, thus allowing the trolley-buses to take up their correct positions in the double line of traffic.

When deciding the position of feeding points, alternative arrangements must be provided to give a supply to any section in event of a failure. This is usually accomplished by linking to the adjacent section, and therefore these conditions should

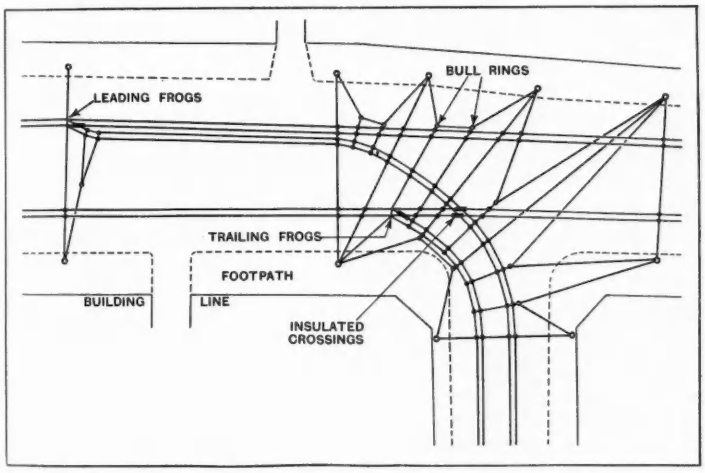


Fig. 2.—Junction layout of overhead equipment

be taken into account when calculating the voltage drop in the trolley wires.

This can be reduced by feeding at the centre of the sections. When the limits of the sections have been fixed, the frequency of buses being already known, the most suitable positions for the sub-stations and their capacities can then be determined. In densely built-up districts some difficulty may be found in obtaining suitable sites, with proper means of access and room for cable routes. The question of town planning regulations may arise, and in residential areas there are likely to be restrictions to the uses to which property may be put.

The positions of cable runs must be decided in conjunction with other users of the roads, such as electricity supply, water, gas and drainage authorities, and in crowded streets where excavations will disorganise traffic, they should be laid in ducts with manholes at convenient intervals so that defective lengths of cable can be easily replaced.

Positions and sizes of poles can be shown roughly on plans before erection, but a visit to the site is also necessary, as this

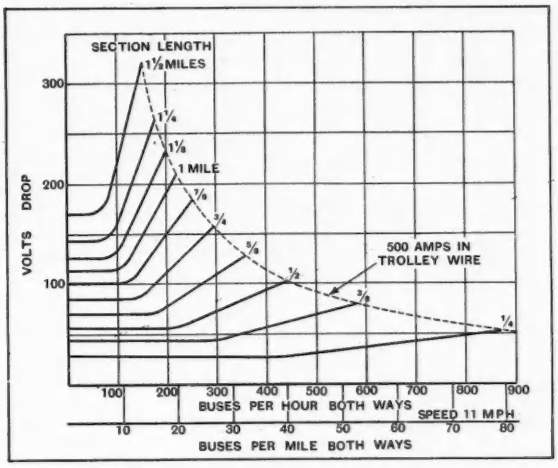


Fig. 1.—Curves showing variation of voltage drop in 4/0 cadmium copper trolley wire with number of trolley-buses and length of sections fed at one end (average speed, 11 m.p.h.; average current, 50 A per trolley-bus; and minimum load per section, 250 A)

will often bring to light features which necessitate modifications. Hence a survey on foot is essential. Even then, trial holes will often reveal obstructions which, if no alternative position can be obtained, will necessitate the provision of special pole supports. Poles should not be within 18 in. of the kerb if it can possibly be avoided, to obviate the likelihood of their being damaged by vehicles which overhang the pavement due to the curved contour of the road.

Special methods are required for securing poles in position where the route passes over bridges, and special attachments are necessary for carrying the trolley wire under bridges. In the latter case, the usual way is to fix a wooden troughing under the bridge, to which insulated hangers are attached (fig. 3). A spring type of hanger (fig. 4) can be used to absorb vertical oscillations of the trolley pole, which might cause the shoe to jump away from the trolley wire when the latter is fixed rigidly and the bus is travelling quickly over a bumpy road. The wooden troughing also prevents the likelihood of damage should there be a dewirement.

When applying to the appropriate authorities for permission to make attachments to their bridges, it will often be found that they are very averse from allowing holes to be drilled in the girder work, and therefore all attachments should, wherever possible, be designed so that this is unnecessary.

The layout of overhead work at junctions requires careful attention. The total weight of fittings is more than twice as much as in the case of tramcars, owing to the use of wires of

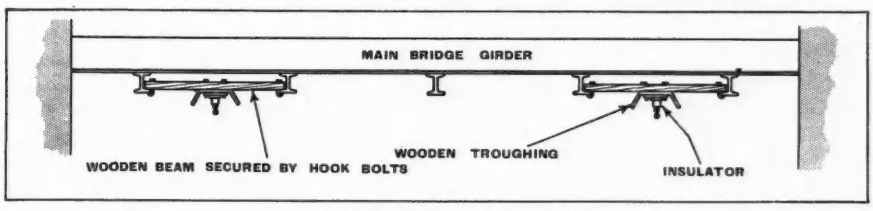


Fig. 3.—Method of negotiating bridges

both polarities and the attendant additional insulation which is necessary.

Where positive and negative wires cross, one must be separated from the other by some form of running strip made from an insulating material. These running strips should be

situated in the pair of wires from which a continuous supply of current is least essential. When one pair of wires is on a curve, these strips should be in the straight run, thus allowing an unbroken supply of current to buses turning the corner, unless other factors, such as gradient or relative importance of route, may make it more desirable to keep the wires continuous in the straight run.

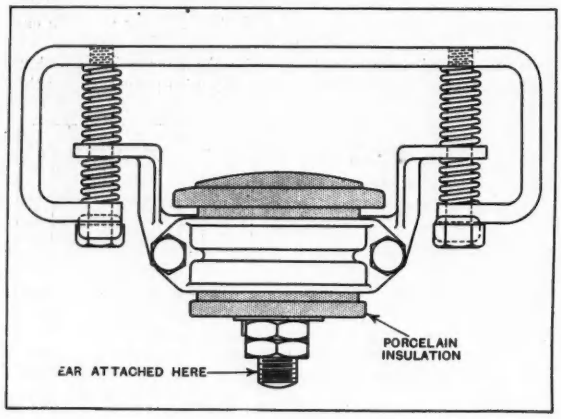


Fig. 4.—Spring hanger

Curves must be carefully "radiused" as any sudden change of direction may cause a trolley to leave the wire. Before plotting the exact position of the trolley wires at these points it is first necessary to observe carefully the lines along which the traffic normally flows. In the junction layout shown in fig. 2 the trolley wires follow round the curve in a line inside that of the traffic in such a position that the trolley poles lie longitudinally to the wire. As a general rule, the change of direction at supporting points should not exceed 5 deg. at ordinary curves, but this may be increased to 8 deg. at junctions and to 12 deg. at turning circles.

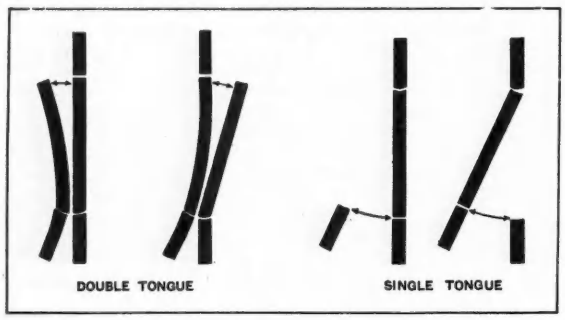


Fig. 5.—Frogs

Traction poles are made to British Standard Specification but the extra loads encountered with trolley-buses has made additional lengths necessary to allow for greater sags. It is the general practice for the poles to be planted 6 ft. in the ground with a foundation of concrete about 2 ft. square, but this must be increased considerably when the resistance of the soil is low, especially where wet clay is concerned. The table shows the maximum safe pressure which can be employed in various types of soil.

Material.	Approximate safe pressure in tons per sq. ft.
Yellow clay (dry)	2 to 2.5
" " (moist)	0.75 to 1.25
London blue clay	4
Coarse sand (dry)	1 to 2
Fine and closely packed sand (dry)	2 to 3
Sandstone	2
Gravel	3 to 4
Soft chalk	0.75 to 3
Limestone	2 to 3
York stone	8 to 9
Hard rock (granite, etc.)	30

The advent of trolley-buses with their higher speeds, freedom of movement across the road and higher energy consumption has been an incentive to research, which has led to considerable improvement in overhead equipment. Frogs of large radius have been designed to attain a more gradual change of direction, and the use of double-tongued leading frogs with a curved tongue for the branch wire eliminates the sudden angle which is unavoidable with the old single-tongue frog (fig. 5). Means for operating the frogs by the driver are now in use. Wear of the trolley wires at fittings has been reduced by constructing the latter in a lighter manner.

The collection of heavier currents and the need for quieter running has necessitated the substitution of shoes for trolley wheels, which has resulted in more attention being paid to the polishing of the trolley wires. Graphite is generally employed for this purpose, being applied in various forms, the most successful of which would appear to be a form of spirit varnish.

Experiments are being made with various insulating materials for running strips at section insulators and crossings in an attempt to discover one which will stand up to wear and arcing and be immune from tracking. A certain degree of success has attended the use of those composed of some forms of asbestos.

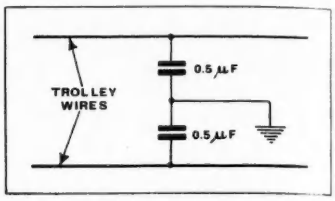


Fig. 6.—Radio-interference suppression

The suppression of radio-frequency oscillations is carried out on the trolley-buses as near as possible to the points at which they are produced. Those which pass these suppression circuits, together with those produced by sparking at the trolley wire, are eliminated by condensers situated at regular intervals along the track. In a typical line-suppressor unit (fig. 6) the capacity across the trolley wires absorbs the symmetrical component of the oscillations, and that between the trolley wires and earth absorbs the asymmetrical component.

Research continues, both on the overhead gear and on the equipment of the trolley-buses themselves, but the modern designs can operate very satisfactorily to the maximum speeds permitted by the Ministry of Transport.

New Type Rotary Switch

THE enclosed rotary control switch with air excluding cover illustrated has been developed by the Kneisley Electric Co., Toledo, Ohio, U.S.A. Its body is of non-carbonising material (claimed to be capable of withstanding 30 kV per inch of thickness) into which are moulded ¼-in. brass contacts. A brass shaft moulded into the bakelite switch handle and riding on two ball bearings rotates an index plate containing eight positioning holes into which a steel ball is forced by the pressure of a helical spring as the handle is turned. The single-unit type has an outside diameter of 4 in., and an overall depth from front of knob to back cover of 2¼ in. Equivalent dimensions for a three-phase ganged model are 4 in. and 5¼ in.

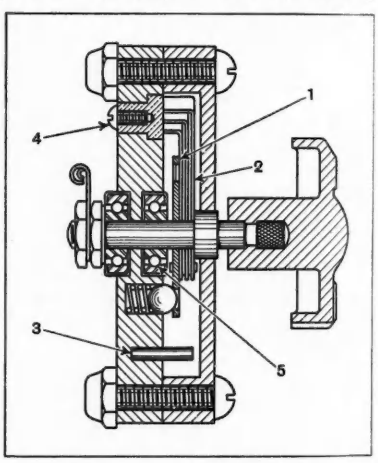


Diagram showing construction of the Kneisley 30-A switch

(1) Index plate. (2) Finger assembly consisting of three phosphor-bronze sections. (3) Steel "stop" separating Nos. 1 and 8 contacts. (4) Contact screw which threads into ¼-in. contact and provides wiring connection. (5) Ball bearing assemblies.

Employment in August

Employment in the engineering industry showed a slight decline between July 18th and August 15th, but continued fair on the whole, remaining good in electrical engineering. According to the *Ministry of Labour Gazette* the number of unemployed in the engineering industry was 94,478, an increase of 1,439, the percentage rising from 8 to 8.1 per cent. (5 per cent. in August, 1937). In electrical engineering the number of unemployed was 6,234 or 5.4 per cent. (5.1 per cent. in July and 2.7 per cent. in August, 1937). In the electrical wiring and contracting industry there was a total of 4,587 out of work, the percentage falling from 12.1 to 11.1. In the electric cable, apparatus, lamps, &c., group the unemployed totalled 12,835, representing a percentage of 7.2 or 0.4 per cent. less than in July, but showing an increase of 1.7 per cent. as compared with August, 1937.

Distribution Efficiency

By F. J. Elliott, A.M.I.E.E.

[H. J. Whitlock & Sons, Ltd.

Mr. Elliott is deputy electrical engineer at Wolverhampton

The author considers that the "per unit" method of dealing with some of the constituent items of distribution costs is not a reliable way of comparing the efficiencies of supply undertakings. He illustrates his argument with curves based upon official statistics.

"Reduction of costs of electricity to the consumer and wider availability of supply must be the primary objectives of any scheme of reorganisation, and our recommendations have been made with these ends in view."

THE extract from the McGowan Report quoted above implies that existing costs are unnecessarily high, and, therefore, at an early stage in the implementation of any scheme of reorganisation, somebody or some individual, will have to adjudicate upon the costs of undertakings. Many articles have appeared in the technical Press in which attempts have been made to compare the efficiencies of large with small undertakings, and I have been struck by the confusion of thought which appears to exist as to the interpretation of "distribution efficiency." An undertaking having the whole of the premises within its area connected to the mains, each of these premises being fully equipped with electricity consuming apparatus, may still be operating inefficiently—a high degree of development does not necessarily include a highly efficient distribution system.

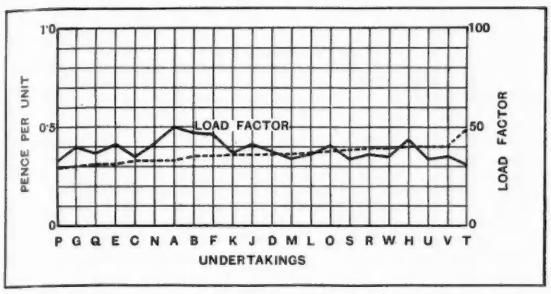


Fig. 1.—Cost of energy, pence per kWh and load factor

Before attempting to compare large undertakings with small, it is advisable to ascertain if undertakings of a similar character and size have similar costs. With that object in view, I have extracted the relevant information from the Electricity Commissioners' Returns, for the year 1936-7, appertaining to all public authority undertakings selling over one hundred million units in that year. The costs associated with the distribution of electricity can be divided under four main headings:—1. Cost of energy. 2. Capital charges on the distribution system. 3. Management expenses. 4. Cost of maintenance and repairs of the distribution system.

Purchase of Energy.—Seeing that all these undertakings now purchase the whole of their requirements from the Central Electricity Board on similar terms, one would expect to find the cost per kWh showing some degree of uniformity where the load factors are similar. A reference to fig. 1, however, shows that the cost of energy in the case of the twenty-two undertakings under consideration varies from 0.29d. to 0.48d. per kWh, and it is very evident that the variation in cost is not entirely due to varying load factors—presumably a large number of these undertakings are purchasing energy under Section 13 of the 1926 Act.

Capital Charges.—The comparison of capital charges presents some difficulty. A reference to fig. 2 shows that in the case of some undertakings, the net debt represents as little as 30-40 per cent. of the total capital expenditure, whereas at the other end of the scale, other undertakings have to bear interest and redemption charges on 60-70 per cent. of the total capital expenditure. To make a true comparison, therefore, it is necessary to assume that the total capital expenditure appearing in the Commissioners' Returns is the true value of the plant in use and that an appropriate allowance has been made for the obsolescence of any plant that has been taken out of commission. If a common rate of interest and redemption is then applied, we arrive at an annual charge which allows of comparison as between one undertaking and another. For the purpose of this article, interest has been calculated at 3¾ per cent. per annum and sinking fund at 3¼ per cent. per annum. The annual charges thus arrived at have been plotted in fig. 3, from which it will be seen that they represent a cost per kWh varying from 0.07d. to 0.32d.

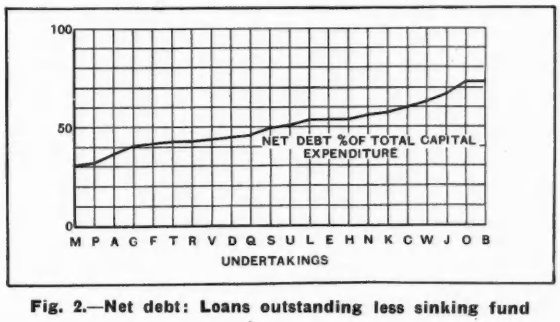


Fig. 2.—Net debt: Loans outstanding less sinking fund

Management Expenses.—From the inception of the electricity supply industry, it has been the practice to analyse costs and express them in terms of kWh sold, although it will be agreed that the standing charges are, to a great extent, fixed by the number of premises to be supplied and the geographical apportionment of those premises over the area of supply. This is particularly true of those expenses usually grouped under the heading of "Management." The management expenses incurred in selling a given number of kWh to 50,000 consumers will be infinitely greater than where the same number is sold to one consumer, and, therefore, no useful purpose is served in expressing "Management Costs" in terms of kWh sold without reference to the number of consumers supplied.

I know of an undertaking selling over 60 per cent. of its total output to 0.1 per cent. of the total number of consumers. The management costs of this undertaking, expressed in terms of pence per kWh, are amongst the lowest in the country. Should, however, this small number of consumers cease to exist, then the management costs would not alter by one iota, but the cost per kWh in respect of management would be increased by some 30 per cent., and the undertaking would cease to rank amongst those with low management costs, without any alteration in the organisation or efficiency of the undertaking.

Distribution Costs.—The contentions in the foregoing paragraph with regard to management apply equally to the cost of distribution, and, in addition to the number of consumers, the expenditure chargeable to distribution will be very materially affected by the proportion of the total output supplied to consumers at primary voltage.

General.—The wide variation in each of the costs, as shown in fig. 3, evidences the impossibility of arriving at any conclusion as to the respective efficiencies of the undertakings.

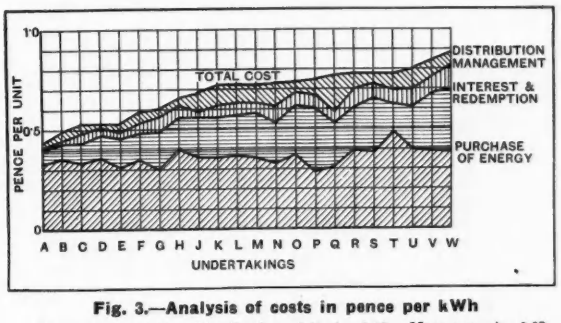


Fig. 3.—Analysis of costs in pence per kWh

Total, 0.43 to 0.89. Distribution, 0.01 to 0.18. Management, 0.02 to 0.11. Interest and redemption, 0.07 to 0.32. Purchase of energy, 0.29 to 0.48.

It is obviously impossible to select a point on the total cost curve in fig. 3 and declare that all undertakings having a cost in excess of that figure are inefficient. The costs plotted in fig. 4 show that not only do the costs per kWh vary over a

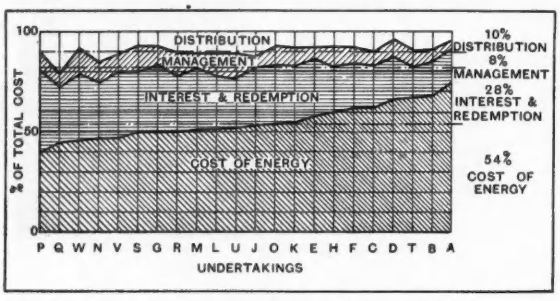


Fig. 4.—Twenty-two municipal undertakings selling over 100 million kWh per annum

Cost of energy, 40 to 75 per cent. of total cost. Interest and redemption, 16 to 41 per cent. Management, 4 to 11 per cent. Distribution, 2.9 to 20 per cent.

wide range, but, in addition, the proportion of the total cost expended under each of the headings also varies enormously.

In the aggregate, these undertakings expend 54 per cent. of the total cost on the purchase of energy, 28 per cent. on interest and redemption, 8 per cent. on management and 10 per cent. on distribution.

There is no other commodity in everyday use where the price to the distributor and the cost of delivery to the consumer vary so widely, and it is difficult to see how any reapportioning of areas alone will bring about the necessary levelling of costs. It is indubitably true that some basis of comparison would be of inestimable value to those responsible for the capital expenditure and operation costs of distribution authorities.

To compare distribution efficiencies of undertakings, it is necessary to possess a very much more intimate knowledge of the conditions appertaining to each undertaking than can be obtained from the figures published in the Annual Returns of the Electricity Commissioners, or from those printed in the annual accounts of supply authorities, and it is questionable whether the costing systems and revenue analyses in use in a large number of undertakings are sufficiently detailed to enable a true picture to be obtained, and, moreover, if such information were available, it would still be necessary to devise some "yardstick" by means of which a true comparison could be made—cost per kWh is not a suitable basis of comparison for many items of expenditure.

The Dairy Show

Electricity's part

WHILE there must have been many persons who regretted the absence of the intimate atmosphere to which they have been accustomed for so many years at the Royal Agricultural Hall, Islington, there is no denying the vastly superior presentation that the additional space at Earls Court made possible at this year's Dairy Show, held from Monday to Thursday this week by the British Dairy Farmers' Association. In recent years it has perhaps been the machinery and equipment sections that have suffered most from the restricted space, and it is fitting that in this, the Diamond Jubilee Show of the Association, these exhibits should have been given the prominence they deserved.

Practically every class of electrically operated equipment included either new or improved apparatus, but, in view of the present tightening-up of the conditions relating to milk production, particular interest is attached to the introduction by Perkins Clean Milk Equipment of a self-contained, all-electric pasteuriser. Especially suitable for the "small man," the extremely compact model shown incorporates two 50-gal. containers and needs no auxiliary equipment. The 12-kW heating elements are thermostatically controlled and a self-record-

The G.E.C. stand at the Dairy Show

ing thermometer is fitted so that the apparatus may be considered almost foolproof. Stainless steel is used entirely for the metalwork and the stirring arms are set at an angle in order to ensure that the movement is not confined to the horizontal plane only. An ⅛-h.p. motor is sufficient to operate these stirrers, a ⅓-h.p. unit driving a milk pump which is incorporated to minimise handling.

Farmers are beginning to appreciate the convenience of electricity for sterilising and are finding that its cost compares favourably with that of other methods. Since the Royal Show at Cardiff this year the G.E.C. has produced two further models of its self-contained electric sterilising chest for dairies. One is a larger type with internal dimensions 3 ft. by 4 ft. square and loaded at 9 kW, while the other, a "junior" model, loaded at 4 kW, measures 2 ft. 6 in. by 2 ft. 9 in. square. The principal features are quick steaming; hot water supply; instantaneous and positive steam cut-off; pressure steam jet for churn stool, &c., and all-metal construction. Other new G.E.C. products shown included an electric churn stool (3 kW) and a floating electrode steam raiser with a steam pressure of 15 lb. per sq. in., evaporation up to 60 lb. per hour, and a loading adjustable up to 20 kW.

Aveling-Barford, who also exhibited a 15-kW electrode boiler (15 lb. per sq. in. pressure, 55/60 lb. per hour evaporation), have now made provision for their electric sterilising chest to be used for supplying steam for the milking stool and an all-metal door is now fitted. Special drying-off arrangements are a feature of an electric steriliser shown for the first time by Martins, while ease of replacement of the steam-raising unit of the Perkins chest will appeal to many users. Approximately 6½ kWh is sufficient for a complete sterilising process utilising one of the new Dairy Supply Co.'s electrode boilers.

Bottle-washing machines were present in full force. Of the simpler types, a new Perkins model, which by means of revolving brushes deals with two bottles at a time, has its ¼-h.p. motor totally enclosed behind a plate-glass shield. Other models were to be seen among the exhibits of the British Miller Hydro Co., Desco, Cockx, R. Powley & Sons, Grabham and Nathan's Sales, one of the larger machines dealing automatically with up to 3,000 bottles an hour being found on the French Bottling Co.'s stand working in conjunction with a bottling and aluminium capping machine of the same capacity.

Milk-handling Equipment

The automatic filling of milk into cartons, which are formed, waxed, filled and sealed in one process, taking only 80 seconds, was demonstrated by Satona, utilising equipment supplied by Hiron & Rempler. A similar demonstration of the use of "Perga" cartons was given by Rappings, Ltd., and the wrapping of butter by means of "Kustner" apparatus was to be seen on the stand of Sutherland Thomson & Co.

Milking machines were represented by Alfa-Laval, R. J. Fullwood & Bland ("Manus"), Gascoignes (Reading), the International Harvester Co. ("McCormick-Deering"), Simplex ("Hinman-Simplex"), Vaccar and Macfords, the last-mentioned company showing a neat portable type. A "Fucoma Gerber" centrifugal apparatus was among the milk testing equipment displayed by Bryan & Paton, other scientific apparatus being presented by Short & Mason.

Milk cooling and refrigeration machinery was not quite so plentiful as usual—possibly manufacturers are preferring the medium of the National Dairy and Ice Cream Exhibition which is to be held at Olympia next month. Frigidaire, the G.E.C. ("Coldair"), York Shipley and others did, however, provide sufficient equipment to indicate the present state of progress in this direction.

The increased demand for process creams, cream cheeses, salad cream and general emulsions caused considerable interest to be taken in the Brush Electrical Engineering Co.'s patent valve homogenisers, four examples of which were on view.

One of the most interesting developments in poultry equipment was seen on the Papworth Industries' stand. Cleanliness of the atmosphere in the incubator has a very considerable effect on the health of the chicks reared. Accordingly, arrangements have been made for the air intake, which is at the bottom of the apparatus, to be carried through the wall of the incubator room to the outside atmosphere, the chill being taken off the air in cold weather by means of a small heating element. The latest type of control unit on the Papworth incubator automatically switches on and off the heating elements, fan and interior light when the door is opened.

Regulation of temperature to within 1/50th of a degree is claimed to be possible by means of the special electrical regulating thermometer employed on the Secura incubators, which embody a dual form of heating, 90 per cent. by hot-water radiators and the remainder by electric heaters. A 24,000-egg unit made by Stephen's Cabinet Incubator Co. was one of the largest equipments on view, other types of incubators, brooders, &c., being exhibited by Cooper-Stewart, H. P. E. Neave, Bingham Appliances, Curfew Electric Appliances, Spratt's Patent and F. A. Young & Son.

The suitability of the electric vehicle for dairy delivery work is becoming more and more appreciated, and a newcomer to the show, Sunbeam Commercial Vehicles, displayed two examples of their new vans. Designed for a maximum load of 15 cwt., these are available in three sizes. The ventilated type motor, which has a large overload capacity, is contactor operated, the electrical equipment being of B.T.H. manufacture. Electric vehicles and batteries were also shown by the Electric Truck & Battery Co., the "Manulectric" milk pram being the principal exhibit of Hole's Electric Vehicles.

General agricultural equipment, made by R. A. Lister & Co., included lighting plants, pumping equipment, dairy equipment and cattle-clipping machines, examples of the last item being also seen on the stands of Cooper-Stewart and the Wolseley Sheep Shearing Machine Co.

Factories in Wartime

Suggested A.R.P. Industrial Organisation

AIR raid precautions are essentially schemes to render mutual help by those liable to suffer personal injury or damage to their property resulting from attack by aircraft, or from the precautionary schemes intended to reduce risk from air attack, *e.g.*, dangers from sudden "black-outs." Those having charge of factories or the operation of plant have need for a special A.R.P. organisation which will enable common problems to be discussed and preparation made to deal with risks which may only be realised when they are pointed out. Engineers and others possessing actual experience of factory operation under war conditions can not only share their information with those in need of it, but in addition can give details of devices it has been found necessary to employ against hazards which previously led to accidents before any remedy was proved necessary.

For example: Men have been either killed or badly injured when power has suddenly been interrupted as a precaution against a raider, through being caught in machinery running under its own momentum because no emergency lighting had been provided. In some cases emergency handlamps had been placed in wall boxes which, however, were hidden in the sudden darkness; this experience proves the need for automatic switching-on of the emergency lights placed at danger points. Elaborate emergency lighting systems need not be installed to prevent danger, the "off" position of a motor-starter handle having a no-volt release can be utilised to close a battery circuit to the emergency lamp. Emergency switches to stop a driving motor are installed as a matter of course, and A.R.P. precautions against light which can assist an enemy will now have to take into account the safety of operatives liable to a new risk. Probably emergency switches to stop motors will incorporate a small emergency lamp which can be so placed that its rays cannot assist an enemy raider.

The need for meetings and discussions is well illustrated by the fire alarm provision of the Factory Act, 1937, which came into force in July last. Section 36 (7) requires in the event of fire "warning to be given which shall be clearly audible throughout a building." This provision might be met by means of hand operated bells; but hundreds of large electric bells with gong diameters of from 6-in. to 12-in. have been installed which depend upon a 230-V a.c. public supply. If the supply is interrupted the fire alarm cannot be given.

At any time there is risk of power being interrupted owing to a short-circuit blowing the main fuses and fire may result from the short-circuit. Most fire brigades install batteries to energise bells which give warning to firemen on duty. Now, if engineers had what might be termed an A.R.P. Industrial Organisation, consideration of the Factory Act requirement for

At the North Wales gathering of the I.E.E. Transmission Section last week-end [*Elec. Rev. photos.*

1. Mr. and Mrs. R. J. J. Swann. 2. Messrs. J. A. Sumner, G. K. Paton, J. L. Eve and W. Fennell. 3. Messrs. R. H. Abel, R. C. Chapman and C. F. Bolton. 4. Messrs. A. N. Mansfield, J. F. Shipley and S. W. Melsom. 5. Mr. R. Borlase Matthews and Dr. W. Wilson (G.E.C.). 6. Messrs. H. W. Grimmitt, F. W. Purse and J. A. Sumner

audible warning in case of fire would have also introduced the emergency lighting question because in both cases an A.R.P. "black-out" would be under review. The battery required to energise the fire-alarm bells could also provide emergency lighting. The fire alarm installation would require, in many cases, the use of thermostats at ceiling height and twin wiring to the fire alarm switchboard. It would cost very little to fix a small lamp at the side of a thermostat when a three-core conductor would enable a common battery to be used for the alarm or emergency light. The labour cost is about the same for a three-core conductor as for a twin-core, so much better value would be obtained for the installation cost and a reduction in factory hazards, quite apart from A.R.P. considerations.

There are many other matters requiring consideration by different engineering branches when the effect of a sudden "black-out" is appreciated. From 1915-18 I was shift engineer at an important explosives factory where naked lights of any kind could not be used. Heating was by means of steam delivered into the danger areas from outside boiler houses. Calorifiers in heater houses heated water which was rapidly circulated over steam-heated tubes by means of rotary pumps driven by three-phase motors. If the electricity supply was interrupted and the heater-house attendant was not present to turn off the steam, the water which had ceased to circulate through the calorifier would eventually have reached the same temperature and pressure as the steam (250 lb.). The low-pressure pipe system for the circulation of hot water would also have been subjected to an increase in pressure with risk of damage. Relief valves had not been fitted and could not be obtained at that time. Eventually the steam valves were fitted with a chain wheel over which a weighted chain was passed and so arranged that it could rotate the valve spindles to the closed position. The weighted chain was held by a catch which the motor contactor switch tripped when reaching the "off" position. Any interruption of the electricity supply therefore tripped the steam valves.

Marine Engineers' Devices

Evidently there is need for automatic releasing gear for steam and similar valve gear because, in the case of shipping, marine engineers found it necessary to make provision against sudden flooding of an engine room. A drum arrangement was fitted to the main stop valves in some ships, several turns of rope being passed round the drum, the end of the rope then being taken up through the engine room skylight to the main deck. In an emergency the rope enabled the steam to be turned off even if the engine room were flooded and filled with steam. This marine risk applies also to land boiler houses and factories using steam because concussion from bombs may cause pipes to fracture and there will be danger from scalding if the valves cannot be closed from some remote point. It is not always certain that safety plugs will act to save a boiler, but in any case if the steam cannot be turned off then nothing can be done until all water has been evaporated from the boiler. Valves can be closed by the weighted chain device and the chain can be released by thermal methods when no electrical means are available. There are some thermal devices employing low melting point waxes, 150 deg. F. and upwards, which can take up strains of several hundred lb. per sq. in. of wax area. Live steam would heat the wax containers and release the weighted chain controlling the valve.

A G.E.C. "brightness" meter being used for measuring the street surface brightness of a London thoroughfare. The instrument is also used for measuring the brightness of cinematograph screens and television tubes

The device fixed up by marine engineers between 1914 and 1918 was found to be of value at any time, because flooding might result from collision in fog. Modern ships now have permanent means of closing engine room valves from the boat deck, which indicates that consideration of wartime risks confers benefits not limited to wartime conditions.

Collaboration between engineers often produces a multiple result benefiting all. A thermal alarm was made for machine bearings to actuate a warning bell in case of undue heating, when special attention to lubrication was urgent. The device was then developed not only to close a switch to the alarm bell, but also to turn on an oil tap controlling an oil reserve. At this stage an engineer concerned with petrol motors suggested a thermally closed petrol tap, operated by the heat from a petrol fire, to prevent a fractured pipe feeding a fire when the tap could not be turned off. A similar device was then required by a gas engineer who complained about earth faults on wiring systems melting lead gas pipes and igniting the gas; but he was not satisfied with a thermally closed gas tap and required it to be operated from a remote point. This was finally done from the battery used for the fire-alarm system. The point of this adventure with a thermally closed tap is that any device of interest to one engineering branch may be useful to other branches, provided engineers of all branches meet to consider common problems such as A.R.P. matters.

The Home Secretary, according to a Press report, suggested a few months ago when he visited the Bristol Chamber of Commerce, that engineers should consider A.R.P. problems as they affected mills, docks, factories, etc. This suggestion, if adopted by all Chambers of Commerce, would enable information to be circulated throughout the whole country. There would be another gain, *viz.*, nobody can be sure just where bombs will drop and the extent of the damage which may put any factory out of action. A mutual scheme whereby all in any area would render assistance in the form of materials, spare plant, skilled labour, etc., would enable quick repairs to be effected; and usually some skilled labour can be released for short periods for urgent repairs which could not otherwise be undertaken if fresh labour had to be recruited under war conditions. Mutual schemes of this description could be organised by the Chambers of Commerce and would prove a valuable form of insurance, not for money, but for a service money could not otherwise purchase. If in any area the majority of factories were damaged so that mutual assistance would be impossible locally, assistance could be obtained from other areas which had suffered no damage. This national organisation seems quite possible because most manufacturers are members of one chamber or another and the chambers are all in touch.

An A.R.P. Industrial Organisation would therefore render mutual help when necessary. It would enable information to be exchanged on the best methods to employ in respect of safety and indicate the apparatus needed, even when such apparatus was not manufactured. Information concerning apparatus needed would interest manufacturers able to produce it and probably extend the use of manufactured apparatus intended for one branch of engineering by introducing it to others who were previously unaware of it.

To the Rescue

THE staff of the Sheffield Electricity Department was able to render yeoman service when a fire occurred at the Newhall Road works of Hadfields, Ltd., on September 21st, interrupted the supply of power to a section of the plant giving employment to about 750 men engaged on important defence programme work, and seemed likely to keep it out of commission for several days. Supply is taken by Hadfields from the Corporation at 38 kV and distributed by them at 11 kV to several sub-stations. It was at one of the latter (due for reconditioning) that the fire started in some v.i.r. cable, burning out a low-voltage distribution board and some overhead circuits, and causing transformer oil to be set alight. The load on this sub-station was about 1,000 kW. Mr. J. R. Struthers, general manager and engineer of the Electricity Department was able to lend Hadfields some new transformers, and to provide labour for their installation and other work necessary for the restoration of the supply. Due to their efforts the shops affected were going again in time for the day shift on September 23rd.

Employers and the I.E.E.

MR. F. LYON, of 59, Antrobus Road, Sutton Coldfield, writes: "Your correspondent, 'W. E. L.,' in the ELECTRICAL REVIEW of September 9th has suggested the formation of an Association of Electrical Engineers which would be truly representative of the best men in the profession. I would suggest that the foundations of such an Association should be settled by a committee and would be pleased if interested electrical engineers would communicate with me (briefly in the first instance) at the address given above. Membership of kindred societies will not necessarily be deemed a disqualification."

New Electrical Products

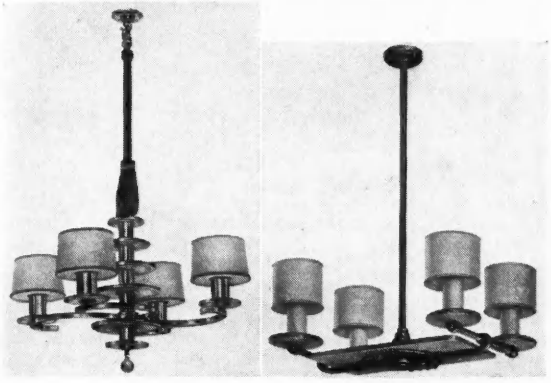
A review of equipment recently marketed

Lighting Fittings

SEVERAL additions have been made to the range of lighting fittings of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.

The metalwork of several of these fittings is of a simulated hammered character finished in old brass or silver colour, with thick cast plate ornamental glass discs which produce a picturesque effect when the lamps are switched on. The cast glass discs match the metalwork, appearing to be of hammered or chiselled finish round the edges and underneath, with either smooth or morocco pattern finish on the upper surface.

Most of the new fittings are of the electrolier type, reminiscent of candelabra design. The usual lamp equipment is from three to four 40- or 60-W lamps, the shades being available in white, champagne or pink, with gimp edges. Suspension is by means of single or double down rods, and multiple



Two new G.E.C. pendant fittings

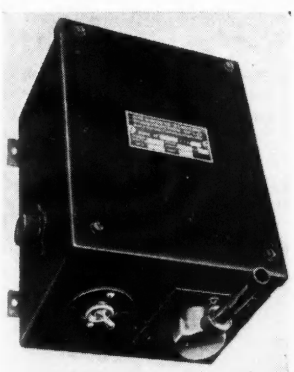
chain suspensions have disappeared. Neat types of wall bracket fittings have been evolved to match.

Another range includes six-light pendants in which are incorporated peach coloured plate-glass discs with clear etching and crystal drops. The metalwork of these is finished in gilt colour with a single rod or ivory silk covered suspension.

A further series of three-light pendants embraces satin silver finished metalwork with pink or white glassware and crystal drops. These are arranged for 40- or 60-W lamps and pink or white shades. There are also pendants with silver-plated metalwork with peach or blue plate-glass discs which produce a very fine lighting effect. Wall bracket fittings to match are available with similar coloured glass discs fixed over the back plates. Other models incorporate coloured glass rods and pressed glassware of modern design.

Extra-low-voltage Transformer

The growing demand for extra-low voltages, such as 12, 25 or 50, for the supply to handlamps and other portable light-current appliances in garages and factories, and for the individual illumination of machine tools is catered for in the new "Safetyvolt" unit, which is being manufactured by the HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD.,



The Hackbridge "Safetyvolt" transformer

Hersham, Walton-on-Thames, in accordance with the requirements of the recently introduced B.S.S. No. 794.

Wiring is simplified, since the "Safetyvolt" unit can be tapped directly off the 400-V power circuit, and the lighting of machines and work benches is carried out by individual lamps of the robust low-voltage traction or automobile type placed exactly where required.

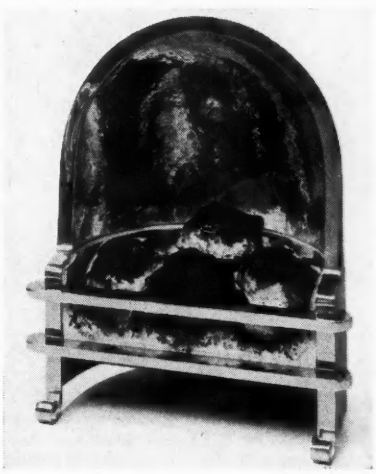
The Hackbridge transformer illustrated includes a double-pole mains switch, easily replaceable fuses and a non-interchangeable socket outlet. The transformer is double-wound with the low-voltage and extra-low-voltage windings mounted concentrically on the centre limb of a three-limb core and separated by a solidly earthed shield, so that the extra-low-voltage winding cannot become charged at the higher potential.

The whole unit is enclosed in a neat sheet-steel case for mounting on machine or wall. Screwed-conduit cable entry is standard, but the arrangements can be adapted to special requirements. The whole of the metal work of the transformer and case are bonded together and may be earthed either through the supply conduit or by means of a terminal on the case.

An Unusual Fire

A new type of imitation coal fire is being manufactured by BRATT COLBRAN, LTD., 10, Mortimer Street, London, W.1.

The elements are concealed and, although they are of the normal plug-in type, the heat actually emanates from the "coal," the whole of the area around and



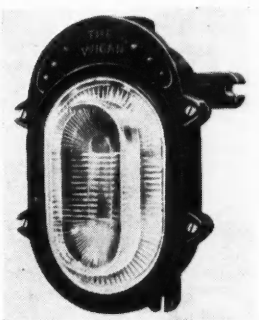
The Bratt Colbran fire

underneath the lumps of coal being a mass of heat so that if paper or cigarette ends are inadvertently thrown into the fire they burn up in exactly the same manner as in an ordinary fire.

A reflector is fitted and the element loading is 2½ kW, a switch being provided to give 1¼ kW if required.

Improved Prismatic Fittings

As from this month all standard "Wigan" prismatic fittings made by HEYES & CO., LTD., Wigan, will incorporate a new prismatic glass. The multi-internal prisms, the design of which is such as to provide the maximum illumination efficiency, combined with the existing external prism, is



The new "Wigan" prismatic fitting

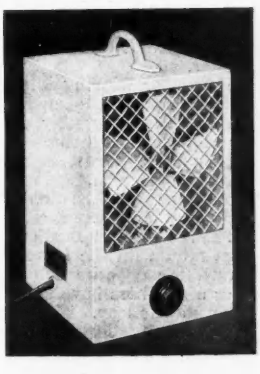
stated to give a more efficient lighting unit, free from glare and of more pleasing appearance.

Earthing Lead

The LIVERPOOL ELECTRIC CABLE CO., LTD., 7, Fortune Lane, London, E.C.1, has just commenced the manufacture of a new earthing lead consisting of a high-conductivity tinned copper conductor covered by a seamless sheath of lead which is chemically inert and thus protects the copper from damage by corrosion. A visible circuit is provided and resistance is reduced to a minimum by the conducting sheath being in continuous contact with the earthing lead. It is sealed completely against corrosion by soldering over the ends and the complete lead is connected to the earthing terminal. It can also be buried in the ground to take the place of the earth plate.

Ozone Apparatus for Cold Stores

A small self-contained ozone producing apparatus (No. 130), complete with its own recirculating fan, has been added to the range of equipment of OZONAIR, LTD., Ozonair House, Longmoore Street, London, S.W.1. It is claimed to be sufficient for a cold room of up to 3,000 cu. ft. The apparatus and fan are housed in a stout metal casing finished in white

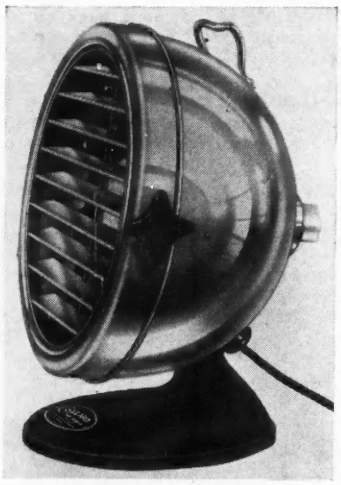


The "Ozonair" model 130 outfit

enamel. Protecting guards are provided and each model is equipped with 9 ft. of 3-core c.t.s. flexible cable. A four-position switch enables the strength of the ozonised air to be altered to suit varying conditions in the room, and the rating is 50 W.

A Bowl-type Fan Heater

The "Collaro" fan-heater is a new product of COLLARO, LTD., Culmore Works, Culmore Road, London, S.E.15. It is built up on a pedestal in the same way as a bowl fire and incorporates a 1½-kW element, radially disposed like the spokes of a wheel from the centre of the diaphragm; behind this is an electric fan which projects the hot air forward through slats which, by means of a knob at the side,



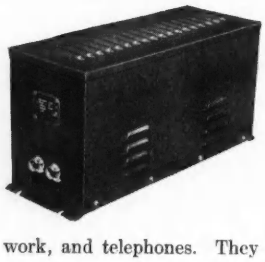
The "Collaro" electric fan heater

can be varied in angle so that the hot air can be circulated in any direction. The slats also serve the purpose of a guard for both fan blades and element.

Control is by a rotary three-position switch at the back. When the heater is "on" a red glow appears in the fan, and when the cool air is circulated a greenish-blue light.

Automatic Voltage Stabiliser

A new series of "Raytheon" voltage regulators has just been introduced by CLAUDE LYONS, LTD., 40, Buckingham Gate, London, S.W.1. These instruments are designed to stabilise at any load from zero to full rating and so may be used as an accessory to devices already installed.



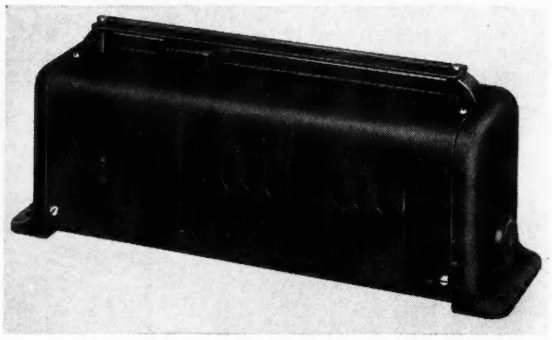
"Raytheon" automatic voltage stabiliser

Some of the types of equipment to which they are applicable are X-ray machines, colour comparators, photo-printing devices, photometers, radio transmitters, ultra-short-wave therapy apparatus, amplifiers for cinema work, and telephones. They are also suitable for laboratories and can be built into many measuring instruments employed in radio-receiver development, such as vacuum-tube voltmeters and signal generators.

A typical "Raytheon" regulator, for example, stabilises an a.c. voltage that may be varying slowly or instantaneously from 190 to 260 V and holds it constant at 230 V with an accuracy of ±1 per cent. It is a magnetic device without moving parts or adjustments, and it can be arranged to operate from any commercial power source and to deliver one or more required voltages, with power outputs varying from 25 W (the smallest size) to several thousand volt-amperes.

Current Regulator

A range of slider regulating resistances has been produced by A. E. W., Ltd., Imperial Works, High Street, Edgware, for use in laboratories and works where it is required to vary the supply of current to apparatus. The smallest model, designed for 0.25 A (continuously) has a resistance of 1,000 ohms and measures (overall) 8 in. long by 4 in. high by 2¾ in. wide; these dimensions are the same for the 10-A type, the resistance of which is 2.2 ohms. The largest model is 26 by 4 by 2¾ in. and is designed for 7,300 ohms at 2.5 A and 12.76 ohms at 10 A. There are twelve intermediate current ratings having seven values of resistances, but others can be supplied.

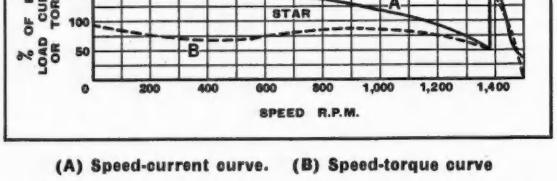


The A.E.W. slider regulating resistance

Oxidised nickel-copper or nickel-chrome alloy, with a temperature co-efficient of 0.000014 per deg. C. is wound on a ventilated refractory former. Protected terminals are arranged so that the unit can be used as a series or potentiometer resistance and the cable entry bush can be removed and conduit screwed directly into the cast-iron end plate. The side thumb-grid operating knob is of bakelite and a protector bar (which is fitted with an indicator scale) prevents contact between the operator and the element of the striker bar.

Low Starting Current Squirrel-cage Motors

A NEW type of low starting current squirrel-cage motor made by HIGGS MOTORS, LTD., Witton, Birmingham, 6, is an attempt to combine the low starting current and high starting torque of a slip-ring machine with the simplicity of construction, reliability and the wearing qualities of a squirrel-cage motor. It is claimed that the starting performance is similar to that of the slip-ring motor, while the efficiency is greater.



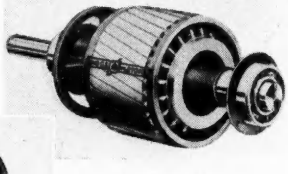
(A) Speed-current curve. (B) Speed-torque curve

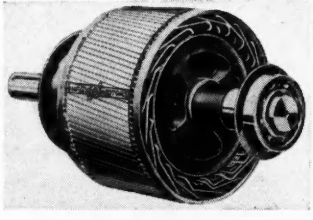
The stator winding is practically identical with that of an ordinary squirrel-cage motor, but the rotor has special features. On its outer periphery is carried the normal squirrel-cage winding. Beneath this is the auxiliary winding consisting of copper or brass bars, each in the form of a loop, or coil, having only one turn. In the core slots are punched to receive these bars. The position of these slots and the pitch of the coil varies for different sizes and types of machine.

The left-hand illustration shows one end of a typical squirrel-cage rotor with the looped ends of the bars. On the right is shown the opposite end of a similar rotor where the loose ends of the bars have been brazed together, each bar forming one complete loop. This method of winding restricts the path of the current in the rotor and reduces it, particularly at starting.

Large holes in the centre of the rotor are provided for ventilation only. Compared with a double squirrel-cage rotor, the tooth area is much larger. Owing to this and the constriction of the rotor currents in the bottom winding, the power factor is said to be much higher than that of a double squirrel-cage motor and to be approximately the same as for a standard squirrel-cage machine, while the starting torque is not obtained at the expense of overload capacity and power factor on load.

With a star-delta starter in the "star" position the company claims that the starting torque varies between 80 and 100 per cent. of full-load running torque with only 1¾ times full-load current, while a slip-ring motor with the normal drum-type starter when starting against approximately full-load torque usually passes about 1¼ to 1½ times full-load current on the first step of resistance. On subsequent steps, however, it usually rises to approximately 1½ to twice full-load current.





Two views of the rotor

Where a relatively high starting torque is necessary, as in the case of compressors and vacuum pumps, the new motor can be designed for direct starting, exerting a starting torque of approximately twice full-load torque with only 3½ times full-load current. This, again, is similar to the performance of a slip-ring motor with a starter suitable for exerting twice full-load torque. A normal high-torque s.c. motor would take about seven or eight times full-load current at starting to exert the same torque.

A.R.P. and Taxation Relief.

By G. V. Harrap, A.M.I.E.E.

Implications and effects of the new Rating Bill

REFERENCES have recently been made in the technical Press to Air Raid Precautions programmes contemplated or put into operation by electrical companies and corporation departments. Outstanding among these are the contracts recently let by the London Power Co., Ltd., for safeguarding its stations. Such contracts mean the expenditure of unremunerative capital, and although Government grants are being made towards the cost incurred, some burden must fall upon individual concerns. Because this capital outlay is required by national necessity and not for the commercial operation of the undertaking, representations have naturally been made in order to relieve employers from liability to pay taxation upon the property constructed. Here, however, a difficulty immediately arises.

Income Tax

Income tax is an annual tax, reimposed by each Finance Act, and is levied upon profits. The statutory profit is determined from the revenue account, but differs from the actual profit because of the laying down of statutory allowances in place of actual disbursements for depreciation, &c. The whole subject is dealt with in the author's recent I.E.E. Premium Paper and in the article entitled "Taxation of Undertakings" (ELEC. REV., December 25th, 1936). It is sufficient to note here that these allowances are detailed in the Income Tax Act, 1918. Rule 3 (a) of Cases I and II of Schedule D definitely precludes expenditure in the nature of capital from being charged against the trading income. Various test cases have been taken to the Courts, and the final dictum is now contained in the following two judgments.

Lord Cave, in British Insulated and Helsby Cables, Ltd., *v.* Atherton, 1926; 42 T.L.R. 187; 10 T.C. 155, expressed the view:

> "But when an expenditure is made, not only once and for all, but with a view to bringing into existence an asset or an advantage for the enduring benefit of a trade, I think there is very good reason, in the absence of special circumstances leading to an opposite conclusion, to treating such expenditure as properly chargeable not to revenue but to capital."

The above judgment was cited with approval in the case of Mitchell *v.* B. W. Noble, Ltd., 1927; 137 L.T.R. 33; 43 T.L.R. 100 & 245, with the following addition:

> "A sum of money expended not necessarily, and with a view to a direct and immediate benefit to the trade, but voluntarily. . . and in order indirectly to facilitate the carrying on of the business, may yet be expended wholly and exclusively for the purposes of trade within the meaning of Rule 3."

It will therefore be seen that, generally speaking, the costs incurred in creating anything which may be regarded as a new asset are not an allowable charge against profits. From this it would appear that allowance for capital expenditure on A.R.P. cannot be charged against income, even though such expenditure, especially in the case of manufacturing firms, may be financed out of revenue. The fact that such expenditure is incurred under statutory direction is no defence, for it has already been decided by the Courts that statutory allocations to sinking funds are not an allowable charge. Since the cost of these precautions cannot be set off against income, the statutory profit will be higher than that shown in the balance sheet and taxation will be increased for the year in which the outlay is made. Efforts are being made to induce the Chancellor of the Exchequer to include a clause in the next Finance Bill to change the law for this special purpose. In assessing the possibilities of success likely to attend this effort it must be appreciated that although the above dictum comes from modern cases, it is only a restatement and clarification of the law as it has always been, even before the consolidation measure of 1918.

Local Rates

As I have previously explained in an I.E.E. paper and in an article entitled "Electricity and Local Rates" (ELEC. REV., October 30th, 1936) the valuation of a hereditament is computed on different bases for public utility undertakings and manufacturing firms. For our present purpose there is no necessity to deal with these; whatever method is used, the desired result is the same, *i.e.*, determination of rateable value.

The provision of air raid shelters and equipment will obviously increase the value of the premises. This is clearly brought out in the case of public utility undertakings, where the rateable value is ascertained by calculating the rent which a hypothetical tenant would pay if the hereditament were let from year to year. The inclusion of air raid protection works would make such a hereditament more attractive to a hypothetical tenant, thereby enhancing the rateable value, and requiring the payment of additional local taxation by the present occupier.

Such increased value does not, however, place the undertaking or manufacturer in a better position for the conduct of his business; the expenditure is undertaken as a contribution towards a national necessity. It was mentioned earlier that Government grants are available for this work, but in the making of an assessment the rating authority would no doubt have considered the total cost involved and not just the undertaker's individual contribution. That this was the most likely possibility was apparently appreciated by the Government, for it has just introduced a short Bill to afford relief from rates in respect of air raid protection works. In its passage through Parliament and its eventual emergence as an Act, there appears to be little likelihood of a material change in the Bill's contents. A few comments upon its provisions may, therefore, be both timely and useful.

> Section 1 (1) is in the following terms: "In ascertaining under the principal Act the value for rating purposes of a hereditament, no regard shall be had (a) to any room or other part of the hereditament which has been added at any time after the hereditament was first assessed, or was included in the hereditament before it was first assessed, solely for the purpose of affording protection in the event of hostile attack from the air, and which is not occupied or used for any other purpose."

This shows that it is an essential condition precedent upon the granting of relief that the room or other part of the hereditament must not be used for other purposes, *i.e.*, for trade. Furthermore, it will not qualify if used for storing articles or equipment connected with the business of the occupier, but may, of course, be used for storing A.R.P. equipment. The first portion of the paragraph illustrates that permanent exemption from rating is envisaged whether the room, &c., be part of a previously existent factory, *i.e.*, one which has already been assessed, or part of a newly built factory which has yet to be valued for purposes of local rating.

Where Relief may be Granted

> Sub-section 1 (1) (b) extends relief from rates: "To any structural alterations or improvements to the hereditament (not being the addition of any such room or other part as aforesaid) made at any time after the hereditament was first assessed, solely for the purpose of affording such protection as aforesaid."

The relief in this case only refers to alterations or improvements made to factories which have already been assessed. By inference, one would presume that it is the Government's attitude that in the building of a new factory, prudent occupiers will normally include structural provision for air raid protection in these "modern" times. Hence no capital expenditure should be incurred upon alterations or improvements. In both Sub-sections there appears the phrase "solely for the purpose of affording protection," and it may be taken that this does not mean merely the protection of employés but also of equipment.

> Section 2 of this Bill states that: "No person shall, in respect of any period, be liable to pay rates in respect of a hereditament which is intended to be occupied and used solely for the purpose of affording such protection as aforesaid, and which is not occupied for any other purpose, or be deemed to be in occupation thereof for rating purposes, and notwithstanding anything in the principal Act no such hereditament shall be included in any rate made in respect of any period."

This deals with the complete hereditament used solely for air raid protection, as distinct from parts of the hereditament granted relief by the previous Section. Under the Factories Act, 1937, it is permissible to split a hereditament into a number of factories, or into factories and workshops. This Bill obviously contemplates a similar legal segregation although a "factory" under the Factories Act, 1937, is not necessarily coincident with a "factory" as defined in the Rating and Valuation Act, 1925. However that may be, there will be occasions when an employer will provide a separate building for air raid protection. Such a building may be used to protect employés, either in the execution of their essential duties, *e.g.*, power station control, or as a means of bodily protection while ceasing work. Buildings may also be erected to house emergency plant and equipment, as at a power station where a generator may be kept as standby for auxiliary supplies. All these will come under the above Section and if they are used and kept *solely* for protection purposes then relief will be granted.

The necessity for keeping these rooms, or complete buildings, ready to afford protection in case of need, as an essential condition towards gaining relief from rates, is emphasised in Section 3, which is as follows:

"The fact that any such room or other part of a hereditament as is referred to in paragraph (a) of Sub-section 1 of this Section, or of any such hereditament as is referred to in the last foregoing Sub-section, having been occupied or used for any purpose other than that of affording such protection as aforesaid, shall, as respects a hereditament in the administrative county of London, for the purposes of Section 47 of the principal Act, be a ground for making and sending to the assessment committee a provisional list and for making a requisition for such a list to be made and sent."

The provisional list mentioned is the first step in valuing and assessing a hereditament for local rates. The system of making assessments within the administrative county of London is slightly different from that in the provinces, and this Section covers the position there. The liability to local rate payments in the latter is covered by Section 2 *ante*, for it specifically states that only so long as the hereditament is used solely for protection purposes will it be free from the imposition of a rate. Although Parliament has recently postponed the revaluation of hereditaments to 1940, annual additions to the present valuation are permissible, while new property is valued as it is completed, even though in many cases it may not be revenue-earning.

The principal Act means, in relation to places outside the administrative county of London, the Rating and Valuation Act, 1925, as subsequently amended. Within the administrative county of London the principal Act is the Valuation (Metropolis) Act, 1869, as amended by the Rating and Valuation Act, 1928, and other legislation.

The present position with regard to the financial side of the air raid protection works is that up to the present no allowance is contemplated for capital expenditure which is admittedly unremunerative, in assessments for income tax. For local rating relief will be granted, as explained in previous paragraphs, subject to compliance with the conditions stated. It is only right that these works, which will be partially constructed with the aid of public money, should not be used for the benefit of the undertaking's or firm's own business and profit making.

Overseas Representation. By A. J. G. Smith

Some curiosities of territory allotment

A RECENT inquiry made to the German manufacturers of a special type of machine brought forth the curious reply that their business with Great Britain was handled by a firm of distributors in the United States, to which address all inquiries should be sent. This is perhaps an extreme case, but in a smaller degree almost every manufacturer, if his system of overseas distribution were examined carefully, would have to confess to a certain number of instances of lack of appreciation of vital factors of distance, communications, and national prejudices in certain of the arrangements made.

In view of the fact that even under the most favourable circumstances export trade development is a matter of considerable difficulty it is very regrettable that more thought is not given in the initial stages of negotiations to the essential limitations of a prospective agent's capacity. Among other cases which have come under my notice of recent years have been the allocation of "Africa south of the equator" to a small firm in Capetown, with little business resulting during the three years of the arrangement. Another case was the allotment of the whole of the Dominion of Canada to a house in Vancouver. In this case the house was a particularly energetic one, and secured its full share of the business moving in British Columbia, but as it was purely a local concern it was obviously absurd to expect potential buyers in Toronto or Montreal to draw their supplies by rail from a stock several thousand miles distant in the west. While similar instances by the hundred might be quoted by anyone whose business brings him into close touch with the export trading arrangements made by manufacturers, it has in justice to be admitted that in many cases the manufacturer is not so much to blame for some of these absurdities as the inveterate habit of many overseas distributors in the initial negotiations to make exaggerated claims for territory, backed up by statements of extreme plausibility to anyone who is not closely acquainted with the local conditions.

To take a case in point, there are many small and medium size importing firms in Calcutta who, within a limited territory, are capable of very good work but who, in any agency negotiations, seldom fail to demand exclusive rights for the whole of India and Ceylon. Any question that may be raised as to their ability to cover such an extent of territory is met by the statement that this is covered by a network of sub-agents and correspondents supported by regular visits from headquarters—a statement which it is extremely difficult to disprove, even though an actual resident on the spot may know from his general experience that only a tenth part of the territory claimed is really covered.

National Prejudice

In certain territories the situation is apt to be obscured a little by the use of general geographical terms to cover a number of markets which have entirely different internal conditions. The disposition to refer to Denmark, Norway, and Sweden under the collective term of "Scandinavia," in a certain measure helps to explain the many instances one finds of an agency for the whole of the three countries being granted to an importer in Copenhagen or even in Oslo, with results that bear no relation whatever to the possibilities of the territory.

Again, even within the scope of a single country there may be special circumstances due to racial prejudices or lack of communications which may make special care advisable. The case of Czechoslovakia is not likely to be overlooked by anyone at the present time, but eight or nine years ago it was not generally appreciated that a German house partially masked by a Czech name as sole distributors might not be quite so profitable as another choice. In Finland, for instance, it is still not generally appreciated in manufacturing quarters that though many of the most important distributing houses are Swedish or of Swedish origin there is a strong movement to promote preferential trading with firms of native Finnish ownership. In such instances a manufacturer has only himself to thank if he is not altogether satisfied with the business that results when an attempt is made to work this territory by means of an agency established (let us say) in the Swedish town of Malmö.

It is not necessary to go outside the British Isles for parallel examples. A number of years ago when the Irish Free State was in its early infancy I had to visit Ireland for the purpose of developing trade in certain engineering products. In Dublin, however, some most promising negotiations seemed likely to be wrecked when I intimated that it was my intention to recognise the political situation frankly by appointing separate distributors in Ulster. The reply of the Dublin house was that on no account would they interest themselves in any proposition in which they could not have rights for the whole of the island.

The reason for this apparently "dog in the manger" policy was not at first clear, but it transpired that the firm had been established for some forty years as an organisation covering the whole of the country, and if at that stage they took up an agency limited to the Free State it was liable to be taken both by their customers and competitors as a tacit admission that the forces of conflicting political tendencies had proved too strong for them, and that as a result they were being gradually circumscribed in scope and obliged to abandon the northern territory. Subsequent events proved that this was actually what happened, but the incident is quoted to show the tenacity with which the man on the spot may occasionally try to deny and disregard facts that are quite patent to an outsider.

An Australian Case

It is occasionally difficult to judge from results whether the allocation of exclusive territory has been excessive. For instance, in one case the allocation of the whole of Australasia to a certain importing organisation there with branch houses established in five centres brought a very large total volume of business, and although with the passage of years and the development of experience the manufacturers had a feeling that the business done in three of the States was not what it should be it was difficult to take any positive steps in the matter, as the Australasian house refused all information as to the exact proportions of trade done in different territories, and although the shipping instructions for various orders gave reasonable evidence that certain territories were unworked the possibilities of coast-wise distribution from the main stocks at different centres was sufficient to prevent any dogmatic assertion upon this point.

One of the best safeguards against any unwise allocation of territory is to follow the late Lord Salisbury's advice to make use of large-scale maps. A study of local conditions including racial trends is also as essential for success in commercial as in diplomatic circles, and it is a safeguard if it is always borne in mind that the average prospective agent seldom makes the mistake of pitching his demands too low, and there are occasions when if he secures 50 per cent. of what he demands he does not regard the outcome of the negotiations as unduly disappointing.

Business and Industrial Notes

National Association of Electrical Retailers. New Lamp Factory. E.D.A. Conference on Water Pumping. United States Domestic Apparatus Exports

Organisation of Electrical Retailers

IN our leading article of August 26th we referred to the formation of the National Association of Electrical Retailers and said that it was the organisers' intention to approach 10,000 electrical retailers with a view to securing them as members. This plan is now being carried out, and we have received from the director and secretary, Mr. L. C. Penwill, a statement upon the objects of the Association, a booklet entitled "This Business of Electrical Retailing," and a membership application form. The statement regards it as an "unthinkable proposition" that each individual trade should set up its own electrical section. What is needed was "a central electrical retailers' organisation truly representative of retailers as a whole and working for the benefit of all electrical traders and departments in all sections of the retail distribution trade." The N.A.E.R. claims to satisfy this need. The new body is sponsored by the National Electrical Contractors' Trading Association, which has had twenty-two years' experience in the safeguarding of the interests of electrical installation contractors and retailers. Purely electrical traders (as distinct from contractor-retailers) were always eligible for membership of N.E.C.T.A., but as the latter association was regarded (wrongly) as essentially a "contractor" organisation it was decided to form the N.A.E.R. as a purely "retailer" organisation under appropriate "retailer" control. Thus membership of the new body is open to all bona fide electrical retailers no matter what other branches of trading they may carry on, and "all electrical retailers are thus able to speak as one voice within the inner councils of the British electrical industry."

The objects of the N.A.E.R. are briefly to give members a status by setting up a register of electrical retailers; to promote the education of salesmen; to encourage the sale of sound and safe electrical appliances; to secure adequate standard trading terms; to eliminate price cutting and "discount snatching"; to give advice and assistance to individual members and to take collective action on behalf of members; and to watch all electrical retailing developments and "to negotiate financial benefits for members." The entrance fee is two guineas and the annual subscription one guinea. These points are amplified in the booklet to which we have referred and which can be obtained from the director and secretary at Africa House, Kingsway, W.C.2.

Supply Company's Claim Fails

At the Horsham County Court last week the Sussex Electricity Supply Co., Ltd., sued Mr. Frederick R. Orrin, a railway fireman, for £1 2s., a year's hire charge in respect of an electric cooker. The *Sussex Daily News* reports that the evidence for the plaintiffs was to the effect that the defendant signed an agreement to hire a cooker. As one of the make he wanted was not in stock he was temporarily provided with one of another type. As a result of complaints the cooker was later removed. The agreement was originally for two years but the charge was reduced to one year's hire which the defendant refused to pay.

The defendant said that although there was a cooker of the type which he wanted in the showroom when he signed the agreement the company refused to let him have it. The cooker which was installed was thoroughly unsatisfactory and the company made no attempt to install the type of cooker for which he had signed when it took the other one away.

His Honour Judge Konstam said that it was clear that the company had done nothing to carry out its contract. He therefore dismissed the claim and awarded Mr. Orrin 11s. 7d. costs.

Giant Fire for Window Display

Berry's Electric, Ltd., have designed a giant "Magicoal" electric fire which has created much interest in window displays, and the effect of which can be seen from a great distance. An impression of the size of the fire can be obtained

A large "Magicoal" fire for window display purposes

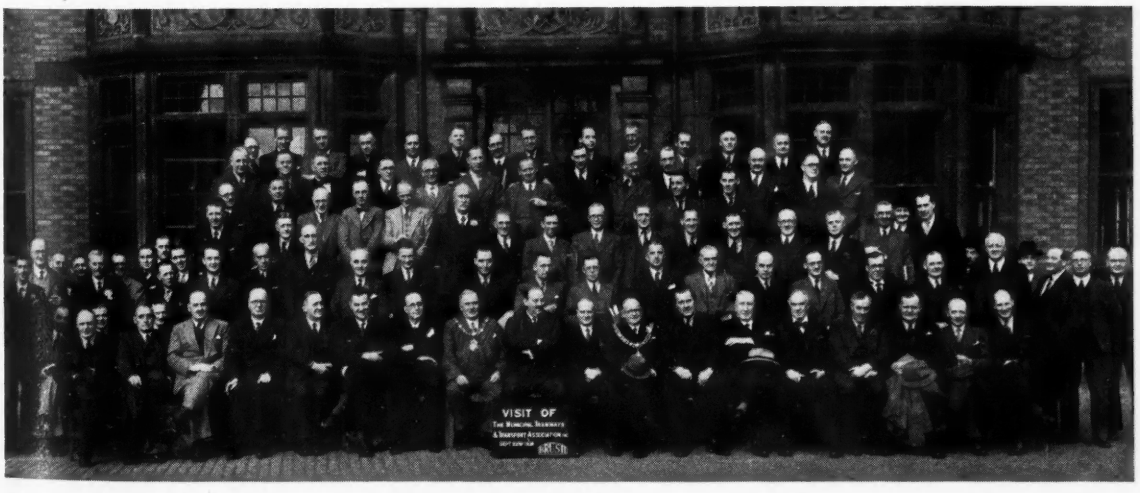
from the accompanying illustration which shows a fire of this type being conveyed from one of the company's vans for installation in a dealer's window.

Two Cinema Contracts

White & Co. ordered from Edison Swan Cables, Ltd., the complete cable requirements for the electric lighting and power installations at the new Warner Theatre in Leicester Square, for use by Troughton & Young, the electrical contractors. In addition 75 per cent. of the lamps used will be "Royal Ediswan," ranging from 60 W to 750 W. The Regal Cinema, Darlaston, includes another recent "Ediswan" cinema contract. For this cinema, the company has supplied the total lamp and cable requirements, and the emergency lighting battery of 110 cells, having 17.8 Ah capacity (three-hour rate).

Works Visit

On September 22nd the Managers Section of the Municipal Tramways and Transport Association paid a visit to the Loughborough works of the Brush Electrical Engineering Co., Ltd. Large orders for bus bodies have been obtained since June and repeat orders for turbo-alternator plant and for Diesel engines and switchgear have also been received. All departments of the works are now well employed. The company recently acquired the oil-engine business of Petters, Ltd., and the work of transferring manufacture from Yeovil to Loughborough is being pushed forward. New machine tools and plant to the value of £150,000 are being installed and will be completed within three months. Apart from the transplanting of Petters' business to Loughborough, large-scale extensions to the Brush works are being planned in order to accommodate the in-



Members of the Municipal Tramways and Transport Association at the Loughborough works of the Brush Electrical Engineering Co., Ltd., last week

creased business in the company's coachbuilding and electrical departments. Mr. T. B. Keep, managing director, stated that the whole of the Brush works, which now cover thirty-six acres, are being thoroughly reorganised and replanned.

New Guiseley Lamp Factory

The new lamp factory at Guiseley of Crompton Parkinson, Ltd., is a four-storey building, designed in modern style by Wallis, Gilbert and Partners, of London, and has a floor area of 115,000 sq. ft. The main stairways and hallways have terrazzo flooring, there are high-speed lifts, a canteen, rest rooms and spacious laboratories. Full advantage has been taken of the opportunity to install the most advanced

The dispatch department at the new Guiseley lamp works of Crompton Parkinson, Ltd.

machinery obtainable and to plan the layout in accordance with modern efficiency-production practice. In this respect, it is of interest that, instead of spreading the production line throughout the factory each bay is equipped with all the requisite machines and is therefore a complete unit in itself, producing lamps through all the stages. Processes are carried out mechanically, except the final packing of the lamp in the carton in which manual labour is still found to have advantages over packing by machine. There are six machines in all. The plant is fully equipped for the pre-production process of glass-making and blowing. The glassworks adjoins the main factory, to which it is connected by a conveyor system, and has a capacity of quarter of a million bulbs per day. Apart from its interest as an excellent example of modern planning the new plant claims attention for the practical measures that have been taken to provide the most favourable working conditions. Over 20,000 sq. ft. of glass, for example, has been used in the building to ensure adequate natural light for the many processes where insufficient light would cause eyestrain. In fact, everything has been done to ensure healthy, pleasant working conditions for the large staff, who have the additional advantages of a five-day week and holidays with pay, not to mention a view which includes the famous Ilkley Moor, and a park presented by the company to Guiseley.

Trade Announcements

Adamson & Co. (Tyne), Ltd., have completed arrangements for the purchase of the stock of the Border Wholesale Supply Co., of Carlisle, and are opening a branch for the service of Cumberland and Westmorland at Phœnix Works, English Damside, Carlisle (tel. 1240). In addition to its normal business as electrical wholesalers the company is agent for Crompton Parkinson, Ltd., for Crompton & Kye lamps, v.i.r. and p.i.l.c. cables, fans and industrial and commercial lighting units including their "Neophan" glassware. The resident representative is Mr. J. M. Hunt, The Cottage, How, How Mill, Carlisle (tel. 232 Hayton). The company now has depôts at South Shields, Newcastle and Carlisle.

Arrangements have been concluded for the business in Fuller stationary, propulsion and other heavier types of batteries to be handled by the Alton Battery Co., Ltd. The Alton Co. will continue its present comprehensive range without change. All inquiries relating to the stationary battery business of the Fuller Accumulator Co. (1926), Ltd., should in future be addressed to the Alton Battery Co., Ltd., Alton, Hants.

The International Refrigerator Co., Ltd., has removed to 54, Victoria Street, London, S.W.1 (telephone Victoria 7174).

The Norwich branch of W. T. Henley's Telegraph Works Co., Ltd., has been removed to 17, Pottergate, Norwich (telephone: Norwich 994).

The Express Refrigerating Co., Ltd., has removed to Park Avenue, North Circular Road, London, N.W.10 (telephone: Willesden 4806).

New Croydon Showrooms

The Croydon Corporation Electricity Committee reports that the Electricity Commissioners have consented to an expenditure of £150,000 on account of the estimated cost (£153,485) of the new central offices and showrooms and will be prepared to consider issuing a further consent or sanction when the final cost of the work has been approximately ascertained. The Commissioners have also consented to a proportion of this expenditure (up to £100,000) being met out of the reserve fund.

Up-to-date Radio

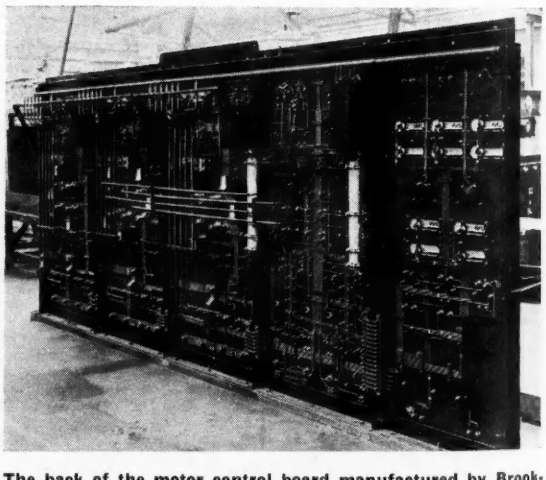
So rapid is the continuous development in the design and construction of wireless receiving and television sets that even experienced people are often at a loss to keep up with improvements. This disability is experienced even more acutely by beginners and novices, who frequently wish for something better than their first set. To assist in keeping completely up-to-date in developments, this week's issue of the *Wireless World* is a special "New Readers'" number in which the value of modern refinements is discussed, completely up-to-date adjuncts to the receiver described and constructional details of a short-wave a.c. mains set are given, together with much other up-to-the-minute information.

Searchlight Publicity

An attractive photographic album containing twenty-five coloured whole-plate enlargements of searchlights and ancillary equipment for military and naval operation has been produced by the London Electric Firm, Croydon. These searchlights are made in all sizes, the largest giving a beam of approximately 3,500 million c.p., and have been supplied to nineteen governments.

E.D.A. (Mid-Eastern Area) Conference

On September 20th at the Assembly Rooms, Boston, at an area conference organised by the Electrical Development Association, Mr. C. H. de Nordwall gave an address illustrated with lantern slides. Electricity for water pumping was the main theme, and in the audience were many representatives of Lincolnshire local authorities and water engineers. Mr. de Nordwall stated that electricity provided the most convenient form of power for town water supply and the electric drive was equally suitable for sewage pumping and land drainage. Rural electrification had also solved the problem of the drought to a great extent. Among water engineers it was common to hear the remark that electricity from the public mains was too costly for water pumping. That might be true in exceptional cases, but it was unjust to apply it as a general criticism of electricity supply. The grid secured the advantage of time, diversity of individual demands, and minimised the amount of plant required, with a consequent reduction in capital outlay. The net result was a distinct economy. Distribution involved a large capital outlay, apart from a considerable annual expenditure on maintenance; it was therefore one of the chief items constituting standing charges. Mr. de Nordwall dealt next with the two-part, flat rate, stepped and restricted tariffs, reminding his listeners that in designing a pumping scheme a plant with a good load factor was more economic to run. It was to be hoped that water engineers would always give their colleagues in the electricity supply industry every opportunity of quoting a suitable tariff for water pumping schemes. In the discussion that followed the points raised were largely on questions of cost. A water engineer suggested that a Diesel system was cheaper to run unless electricity could be bought at under 0.3d. per kWh. He also alleged that the Ministry of Health was determined to "boost" the grid. Mr. C. E. Maguire emphasised that cost depended very much upon circumstances. Sixpence might be cheap for some purposes, a farthing dear for others. Two other speakers said that they preferred the Diesel engine.



The back of the motor control board manufactured by Brookhirst Switchgear, Ltd., for the steering gear of the "Queen Elizabeth." **(See page 445)**

The Sheffield Showrooms

A feature of the new showrooms of the Sheffield Electricity Department, reference to which was recently made in the ELECTRICAL REVIEW, is the installation of Holophane "built-

in" fittings. The company states that this is one of the first showrooms in the country to adopt a "built-in" architectural lighting scheme, which in this case makes use of the square drop panel type "Controlens" fittings.

Transporting a Large Transformer

The British Thomson-Houston Co., Ltd., has in hand an order for seven 18,000 kVA transformers for the Bristol Corporation. Special transport arrangements are made for conveying these large machines from Rugby to Bristol, and our picture shows one of the transformers in course of transit. The load weighed forty-four tons and measured 17 ft. 4 in., by 7 ft. 7 in. by 12 ft. 8 in.

A large B.T.H. transformer en route for the Bristol Corporation power station

Radio Exhibition in Ceylon

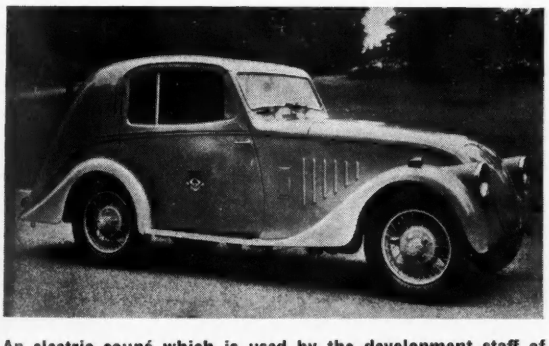
The Radio Club of Ceylon, which was founded in 1922 for the purpose of promoting and organising the development of amateur radio-telegraphy and broadcasting in Ceylon and South India, has decided to hold an exhibition of radio and electrical apparatus in the University College Hall in Colombo during October. The exhibition is being promoted with a view to increasing the interest in broadcasting and is being supported by the Telecommunication Department and the Department of Electrical Undertakings in the Island. The Government of Ceylon is following a progressive policy in the matter of the provision of funds for broadcasting. In the estimates of expenditure 1938-39 the Committee of Communications and Works has received a sum of Rs.40,575 for broadcasting programmes to meet the growing needs of listeners.

Monel Metal

The alloy known as Monel, which contains upwards of 65 per cent. nickel and 26 per cent. copper, finds uses mainly where resistance to corrosion and acid attack is required. In power plant Monel is used for internal parts of steam, water, gas and compressed-air systems, and for such electrical accessories as lamp-socket screws, bolts, nuts and overhead pole-line work. Full technical particulars are given in the "Monel Data Book," issued by Henry Wiggin and Co., Ltd. This contains a summary of the properties of Monel, nickel and the more recent Inconel, together with working instructions and tables, with especial reference to sheet-metal uses.

An Electric Coupé

The Ealing Corporation Electricity Department has recently purchased an electric coupé for the use of the development staff. The car, which was supplied by Partridge, Wilson & Co., is of the two-seater type with space at the back of the seats for small appliances. The "Exide" 60-V battery gives a range of 30-35 miles, the maximum speed of the vehicle being 27-28 m.p.h. on the level and the consumption 5 Ah per mile. Although it has only been in use for a short time the car has created a good deal of interest, and has on a number of occasions been used for transporting consumers to the showrooms to enable them to inspect electrical apparatus. The vehicle is finished in silver and electric blue.



An electric coupé which is used by the development staff of Ealing Corporation Electricity Department

A Window Centre Display

An attractive window centre for displaying G.E.C. fires, domestic appliances or a combination of both is now available from the General Electric Co., Ltd. Before this year it was the G.E.C.s practice to issue separate displays for household appliances and fires, but this year's is suitable for either. The display measures approximately 6 ft. square, but is very effective in much larger windows when the sides of the window are built up with fires or appliances. Construction is of substantial plywood, while the principal sales message in the centre is painted on linen and can be illuminated from behind, provision being made for lamps. The display is installed by the G.E.C. and at the end of a fortnight is dismantled and taken away.

A Boiler Plant Order

A Simon-Carves multiple-drum type boiler having a capacity of 50,000 lb. of steam per hr. is to be installed at the Redbourn works of Richard Thomas & Co., Ltd. The unit will be complete with economiser and air preheater, and the operation of the boiler will be controlled automatically. The firing is on the direct system with blast-furnace gas. The plant forms part of a reorganisation scheme similar to that recently completed at Ebbw Vale, where three Simon-Carves boilers were installed for the same company.

B.I.F. by Camera

The cameraman has caught the essentials of the B.I.F. display at Olympia and Earls Court in London and at Castle Bromwich, Birmingham. The result is an illustrated brochure which will be issued to 108,000 buyers in more than one hundred countries. This brochure, which will be printed in English, French, Spanish, Dutch, Portuguese, Danish, Italian, German, Polish and Swedish, will be distributed to overseas buyers all over the world. It conveys at a glance not only the immense range of goods to be seen at the Fair, but also the distinction in design that marks the latest British products.

United States Exports of Domestic Apparatus

In the first half of this year there was a decline in the overseas demand for American domestic electrical appliances. The following table shows that the exports of such goods during the period mentioned attained a value of £1,767,852, a decrease of £269,391 as compared with the corresponding half of 1937.

	January to June. 1937.		1938.	
	No.	Value, £.	No.	Value, £.
Household refrigerators ...	101,944	1,488,933	75,899	1,120,901
Electric fans	80,832	68,450	79,042	79,010
Electric washing machines and parts	24,682	190,060	32,516	271,710
Electric vacuum cleaners ...	14,350	53,693	16,930	63,382
Electric vacuum cleaner parts...	—	31,120	—	37,639
Electric irons	96,724	31,380	96,056	33,902
Electric cooking ranges ...	2,772	33,374	2,974	32,624
Electric heaters and ovens ...	12,993	15,001	8,719	12,850
Other domestic electric utensils	103,096	48,388	91,263	48,320
Other domestic elec. appliances	29,272	76,834	33,665	67,514
Total		£2,037,243		£1,767,852

Motor Control

Brookhirst Switchgear, Ltd., has issued a booklet in which are brought together photographs of some installations of starter switchboards for grouped electric drives. This construction incorporates bus-bars and provides facilities for combining control gear with distribution gear in one flush-fronted easily-extendible steel enclosure. The booklet is of interest, not only because the illustrations are early samples of a new development, but also because it will assist those responsible for the layout and installation of control gear to appreciate more easily the application and advantages of switchboard construction.

Standardised Radio Components

The Radio Component Manufacturers' Federation now has twenty separate groups working on recommended practices and definite standards, to which several additions have recently been issued, together with addenda sheets for keeping the Standards Book up to date.

I.E.E. South Midland Students

The opening meeting of the 1938-39 session of the South Midland Students' Section of the Institution of Electrical Engineers will be held on October 3rd at the James Watt Memorial Institute, Birmingham, at 7 p.m., when Mr. J. E. Woollaston (chairman of the Section), will deliver an address on "Automatic Control."

Junior Institution of Engineers (Midland Section)

The annual general meeting of the Midland Section of the Junior Institution of Engineers will be held on October 5th

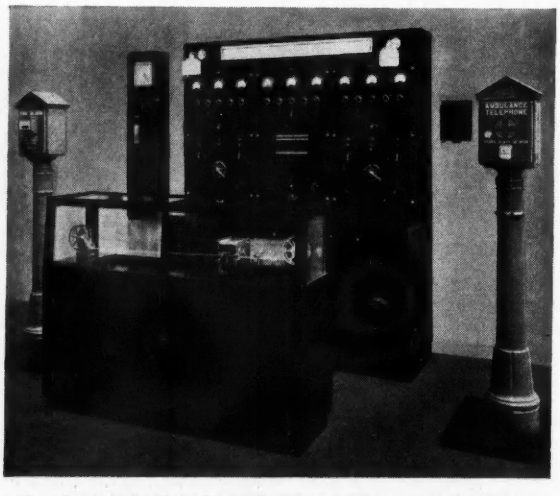
at the James Watt Memorial Institute, Birmingham, when Mr. R. L. Kirlew will deliver his chairman's address on "The Naval Reserve and Wireless Telegraphy."

Bus Bodies for Barrow

The English Electric Co., Ltd., has received a repeat order from the Barrow Corporation for six double deck bus bodies to seat fifty-two passengers. These will be of the company's latest reinforced composite construction.

Brighton Fire Week Conference

At the British Fire Week Exhibition held at Brighton during last week, the Automatic Telephone & Electric Co., Ltd., exhibited street fire alarm apparatus. The exhibit consisted of two types of street boxes and associated station equipment, in the form of a two-loop switchboard, a register cabinet, and an illuminated street box number indicator. One of the street boxes was of the type supplied extensively to the London



The Automatic Telephone & Electric Co.'s exhibit at the Brighton Fire Conference

County Council for the protection of areas which are the responsibility of the London Fire Brigade. The other box was a double-headed fire and ambulance telephone box, containing on one side the usual "pull-handle" fire alarm mechanism, and on the other a standard Post Office type hand set telephone for ambulance calls. Of particular interest was the most recent development in connection with A.T.M. fire alarm equipment. This enables an alarm to be sent immediately from a short-circuited box instead of the call being transmitted after a brief delay, as has hitherto been the case. Upon an alarm call being originated from a box which has a short-circuit condition associated with it, transmission to the station is effected instantly and all station services associated with the receipt of the call function without interruption. In addition, the faulty condition on the line is recorded by means of a fault bell and a lamp, whilst the fault display panel on the top of the switchboard is illuminated. This enables the short circuit to be cleared quickly.

Prices of Materials

Henry Gardner & Co., Ltd., report, September 28th: Copper bars (best selected), sheet and rod, no change. English pig lead, £17 10s., 10s. decrease. Spelter, £14 15s., 7s. 6d. increase. English block tin, £195 5s., £2 10s. decrease. Mercury, no change.

Frederick Smith & Co. report, September 28th: Electrolytic copper bars, £48 10s., 10s. decrease. Ditto, ditto, wire rods, £53 5s., 10s. decrease. Ditto, ditto, h.c. wire, 7$\frac{13}{16}$d., $\frac{1}{16}$d. decrease. Silicium bronze wire, 9$\frac{3}{8}$d., $\frac{3}{16}$d. increase.

Edward Till & Co., report, September 28th: India-rubber, Para fine, no change.

Appointments Vacant

Assistant manager for the East Devon Electricity Co., Ltd.

Showroom assistant (male) for Rugby Electricity Department.

Lady demonstrator and showroom assistant for Cleethorpes Electricity Department.

Two electrical engineers for power stations and electrical engineer for the mains department for the Calcutta Electric Supply Corporation, Ltd.

Installation superintendent for Guildford Electricity Department.

Junior mains assistant for Whitehaven Electricity Department.

Assistants in the consumers' engineer's office of the Scottish Southern Electric Supply Co., Ltd.

Lady demonstrator and showroom assistant for Luton Corporation.

Assistant contract engineers for Fulham Electricity Department.

(See our classified advertisements.)

New Catalogues and Lists

Union Lamp & Lighting Co., Ltd., Abbeydale Road, Wembley.—A price list of "Union" lamps, including motor-car lamps.

Darwins, Ltd., Fitzwilliam Works, Sheffield.—A catalogue of magnets and magnet steels.

McNaught Lamps, Ltd., Lawson's Road, Thornton.—Leaflets dealing with fog lamps and anti-dazzle lamps for motor-cars.

Metropolitan-Vickers Electrical Co., Ltd., 75-77, Margaret Street, London, W.1.—A notification of reduced condenser and control box prices.

Castelco (Great Britain), Ltd., 91, Southwark Street, London, S.E.1.—An eight-page illustrated leaflet (No. 938) dealing with special low- and high-voltage switches for general application, including radio and motor vehicles.

Thos. W. Ward, Ltd., Albion Works, Sheffield.—A 625-page illustrated catalogue of machinery, engineers' tools, engines, boilers and contractors' plant.

British Electrical Repairs, Ltd., 218, Witton Lane, Birmingham, 6.—A leaflet dealing with the company's repair service.

G. Bray & Co., Ltd., Leeds, 2.—A catalogue of electric air heaters.

Brook Motors, Ltd., Empress Works, Huddersfield.—Booklets dealing with electric motors in the wire industry and machine tool motors.

Ceag, Ltd., Barnsley.—A pamphlet giving details and illustrations of handlamps and inspection lamps for air raid precautions.

Runbaken Electrical Products, 13-15, Liverpool Road, Deansgate, Manchester, 3.—Particulars of the "Autostil" electric water distiller.

Bankruptcy Proceedings

N. G. Crews, 99, Clapham Road, lately 34, Crown Street, both Lowestoft, electrical engineer.—The application for discharge was heard at the Town Hall, Great Yarmouth, on September 22nd. The Official Receiver said that debtor filed his petition and the receiving order was made in June, 1932. The liabilities amounted to £168 and the assets had realised £23. A first and final dividend of 9d. in the £ had been paid. The discharge was granted subject to three months' suspension.

J. T. Townson, 97, Market Street, Dalton-in-Furness, radio and electrical engineer.—This debtor's public examination took place at Barrow-in-Furness recently. His statement of affairs showed gross liabilities of £406, of which £399 was expected to rank, with estimated assets of £68, leaving a deficiency of £331. Debtor attributed his failure to bad trade since Christmas last year. The examination was closed.

S. Saunders, radio dealer, 111, Greenford Road, Greenford, Middlesex.—Receiving order made September 14th on a creditor's petition.

J. S. Lowden (otherwise known as H. R. Bishop), radio dealer, 175, Piccadilly, London.—Last day for receiving proofs for dividend October 6th. Trustee, Mr. H. H. Gaine, Bankruptcy Buildings, Carey Street, London, W.C.2, Official Receiver.

A. T. White, electrical engineer, Radio House, High Street, Hadlow.—First and final dividend of 4s. 6d. in the £, payable September 27th at 6 and 7, Old Steine, Brighton.

A. G. Field, radio dealer, 27, Station Road, Chadwell Heath.—Receiving order made September 20th on debtor's own petition.

W. A. Mather (Mather's Stores), radio dealer, 77, Widnes Road, Widnes.—Receiving order made September 19th on debtor's own petition.

V. W. Henry, radio and electrical engineer, Acle, Norfolk.—First meeting September 30th at the Official Receiver's office, Castle Chambers, Opie Street, Norwich. Public examination October 18th at the Shirehall, Norwich.

J. E. Madden, radio dealer, 113, Bradford Road, Huddersfield.—Trustee, Mr. G. W. Smith, 23, John William Street, Huddersfield, released August 26th.

J. T. Southwood, electrical engineer, 13, Brandreath Road, Compton, Plymouth.—First and final dividend of $\frac{3}{4}$d. in the £, payable September 28th at 11, St. Aubyn Street, Devonport, Plymouth.

Company Liquidations

Surrey Radio Services, Ltd., 356, High Street, Sutton, Surrey.—The statutory meeting of creditors was held recently at Sutton, Surrey, when it was reported that the ranking liabilities were £1,139, against assets estimated by the directors to realise £438, leaving a deficiency of £700 so far as the creditors were concerned. It was stated that between October 1st, 1937, and September 10th of the present year the trading had resulted in a loss of £455. The creditors decided that the voluntary liquidation of the company should be continued with Mr. C. Latham, accountant, of 185-188, High Holborn, London, W.C., as liquidator. A committee was also appointed.

Dasnieres, Ltd.—Particulars of claims by October 18th, to the liquidator, Mr. R. L. Latimer, 4B, Fredericks Place, Old Jewry, London, E.C.2.

Tisbury Electric Supply Co., Ltd.—Meeting October 28th, at Thames House, Millbank, London, S.W.1, to receive an account of the winding-up by the liquidator, Mr. E. J. Harrison.

Lymington Electric Light & Power Co., Ltd.—Meeting October 28th at Thames House, Millbank, London, S.W.1, to receive an account of the winding-up by the liquidator, Mr. E. J. Harrison.

Dissolution of Partnership

Huxford Sanderson Co., electrical engineers, 57, Buller Street, Grimsby.—Messrs. E. J. Huxford and W. Sanderson have dissolved partnership. Mr. Huxford will attend to debts.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

CRUSADER table lamp.

GROSVENOR muscanite utility lamp.

TWO-COLOUR prismatic reflecting switchboard signal lamp.

Electricity Supply

Lighting, Domestic, Power

Bexhill.—CENTRALISED CONTROL SCHEME.—The borough electrical engineer is to submit to the Electricity Committee a full report and estimate of the cost of installing the "Actadis" system for centralised control of street lighting and other services.

Birkenhead.—SUB-STATION.—At a recent meeting of the Council it was reported that the Central Electricity Board had purchased a site for the erection of a sub-station at Prenton.

Blaydon-on-Tyne.—OVERHEAD LINE.—Approval has been given by the Urban District Council to plans submitted by the North-Eastern Electric Supply Co., Ltd., for an overhead line from Winlaton to Norman's Riding Hospital and Barlow, an

An effective means of advertisement

Above: The Grand Hotel, Clacton-on-Sea, illuminated by Metrovick Type "B" floodlighting fittings and clear gasfilled lamps. The installation was carried out by Universal Installation, Ltd., Clacton. Right: The Hawthorns Hotel, Bournemouth, floodlighted by 400-W "Sieray" electric-discharge lamps housed in four Siemens "Oxford" horizontal and four "Brentford" vertical projectors. Aish & Co., Bournemouth, were the contractors

underground cable at Scotswood-Hexham Road, and an underground cable and reconstruction of overhead network at Wylam View and Denton View, Hallgarth estate.

Carlisle.—EXTENSIONS.—A supply of electricity is to be given to Bankdale Park, Burthwaite, Boothby, Naworth Castle, Hawksdale Hall and Rose Castle, at a cost of £4,320.

Chester.—ELECTRICITY IN COUNCIL HOUSES.—The Housing Committee has arranged for the Electricity Department to install electricity in 80 houses on the Lache estate at a cost of £700.

LOANS.—Permission is being sought to borrow £327,716 for the extension of the Queensferry power station and in the event of refusal it is proposed to ask for a local inquiry.

YEAR'S PROGRESS.—Mr. S. E. Britton, the engineer and manager, reports that 1,400 additional consumers were connected during the past year, bringing the total to 19,555, and the quantity of electricity sold rose by 4.1 million kWh to 28.6 million kWh. Of 1,597 agricultural holdings in the area 710 are connected to the supply, and last year purchased 2.7 million kWh. The total number of consumers is equivalent to 73.4 per cent. of the total premises, the greatest development being in the Hoole urban district where 98.4 per cent. of the premises are connected. In the supply area as a whole the consumption was equal to 368 kWh per annum.

Croydon.—AIR RAID PRECAUTIONS.—The Electricity Committee recommends a scheme estimated to cost £8,809 for air raid precautions.

Exeter.—EXTENSION.—The Electricity Committee is to extend the mains to Shillingford at a cost of £1,200. The Committee is also applying for permission to borrow £30,000 for mains and services.

Guildford.—SUPPLY EXTENSIONS.—The Electricity Committee proposes to extend the mains to Thorncombe Street at a cost of £3,100, and to the Aldershot Road area (£1,200).

High Wycombe.—PROPOSAL TO PURCHASE UNDERTAKING.—At a meeting last week the Town Council adopted a recommendation of the Lighting Committee that it should exercise its option to purchase the undertaking of the Wycombe (Borough) Electric Light & Power Co., Ltd. Councillor W. S. Toms, chairman of the Committee, said that the probable outlay would be £250,000, but it would not involve any charge on the rates.

Kettering.—CHARTER CELEBRATIONS.—Yesterday (Thursday) Kettering became a borough and an elaborate scheme of floodlighting was arranged by the Council in connection with the celebrations.

Kimpton (Herts).—SUPPLY EXTENSION.—The "Northmet" Company has in hand an extension of the supply to Peter's Green. An early start with the work is expected.

Leeds.—DUST PRECIPITATION.—At a recent meeting of the Electricity Committee Mr. C. A. Goodall, the chairman, stated that two reports had been received from Prof. J. W. Cobb, Livesey Professor of Coal Gas and Fuel Industries at Leeds University, dealing with tests and observations carried out following the installation of electrostatic dust precipitation plant at the Kirkstall power station. These showed that the dust nuisance, which had caused numerous complaints, was almost completely eliminated.

Leicester.—STREET LIGHTING POLICY.—The Watch Committee has rejected an offer by the Gas Committee to provide gas lighting in the main thoroughfares of the city from Welford Place to Sanvey Gate. After considering the matter at length the Watch Committee stated that it was in favour of the complete electrification of the city's street lighting, it being a vital part of Leicester's A.R.P. plans that street lighting should be all-electric and so able to be extinguished at a moment's notice.

London.—POPLAR.—The Electricity Committee is applying for permission to borrow £15,000 for mains.

A suggestion of the borough electrical engineer that, as an experiment, the street lighting in Blair Street should be changed to sodium lighting has been approved by the Electricity Committee. The total wattage will be reduced, resulting in a saving of £75 per annum on energy, but the lumen output of the lamps will be substantially increased.

FULHAM.—It is reported that the s.s. Fulham IV will be launched on October 25th.

Owing to the continued growth of the undertaking the provision of additional showroom accommodation and new premises for the renovation department and distribution stores has become imperative, and it is proposed to purchase a site at Effie Road for £10,750.

HAMMERSMITH.—The Council has approved of the expenditure of £2,000 on A.R.P. work at the power station.

The work of erecting new lamps on the trolley-bus poles commenced recently in Queen Street and is proceeding northwards along Brook Green Road and Shepherd's Bush Road. The new lighting columns required for various streets are in course of manufacture and their erection will be proceeded with as they are delivered.

Mirfield.—INCREASED SALES.—In the past year the Electricity Department sold 1,668,000 kWh, an increase of 26 per cent. over the previous year's sales, the average cost to consumers being 1.748d., against 2.085d. in 1936-37.

Oldham.—APPARATUS ON HIRE.—At a recent meeting of the Electricity Committee a reduction in the simple hire terms for electrical appliances was urged. It was stated that while the Electricity Department had 5,797 appliances on simple hire the Gas Department had 39,000. Comparisons of the charges of Electricity Department and the gas undertaking showed that people paid 6s. to 7s. 6d. for hiring new electric cookers and 4s. 6d. to 5s. for reconditioned types. The Gas Department charged 3s. 6d. to 4s. for new cookers. Electric washboilers were 2s. a quarter and gas 1s. 1d. Electric fires were 2s. to 3s. 6d. and gas fires 1s. 3d. to 1s. 9d. It was thought that it would be possible for the Electricity Department to make substantial reductions in the charges for hire and also have refrigerators and washers on simple hire. The chairman of the Committee promised to consider the matter.

Preston.—REDUCED TARIFFS.—The following reductions are to be made in tariffs from December 1st next: Lighting: reduction of ¼d. per kWh. Annual minimum charge to be

reduced from £1 13s. 4d. to £1 5s. Home system: "unit" charge to be ½d. per kWh for all consumption during two quarters of the year, instead of during one quarter as at present. Fixed charge to be based on rateable value of the premises, including those below £10. Minimum consumption to be raised from 36 to 40 kWh per £1 of rateable value: Shop window lighting and signs: for the first 1,000 kWh per quarter, 1½d. instead of 2¼d. per kWh. For the next 1,000 kWh per quarter, 1¼d. per kWh; and for all over 2,000 kWh per quarter, 1d. per kWh. Cinemas and theatres: flat rate charge to be 4d. per kWh (less 5 per cent.) instead of 4½d. (less 10 per cent.). Two-part rate of £8 per kW of maximum demand plus 1½d. per kWh (less 10 per cent.) to be altered to £8 per kWh plus 1d. per kWh (less 5 per cent.).

Pegswood (Northumberland).—ELECTRIC LIGHTING.—A start has been made on installing electricity in houses in the vicinity of Pegswood Colliery, where hitherto oil lamps have been used.

Southampton.—DEPARTMENT'S PROGRESS.—With the single exception of traction supplies the sales of the Electricity Department again increased satisfactorily, states Mr. W. G. Turner, borough electrical engineer, in his report for the past year. Under the two-part tariffs, for instance, consumption increased by more than 35 per cent. to a total of 11.8 million kWh, and there was a similar proportionate expansion in supplies for public lighting, which totalled 3.3 million kWh. Excluding bulk supplies the Department sold 82.5 million kWh (an increase of about 11 per cent.), equivalent to 375 kWh per head of the population. The number of domestic electrical appliances hired or sold on h.p. terms during the

A sodium-lighted road at Ipoh, F.M.S.

year was 4,370, compared with 4,317 in the previous year. Hired wiring installations to the number of 896 were completed, making the total since 1926 17,717, all carried out by local contractors, who also were given the work of domestic wiring in conjunction with the hire of cookers, water heaters, &c. Out of a provisional surplus of £97,446 on the year's working £50,294 has been paid for items mostly of a capital nature. In addition a sum of £12,300 has been contributed in aid of the rates, making the total so applied £121,300.

Southend.—BALANCING THE ACCOUNTS.—In July last the borough electrical engineer of Southend-on-Sea (Mr. A. C. Johnson) forecast a small adverse balance on his department's accounts for the current year. He was asked to ascertain what revision could be made to ensure a balance on the right side and he has now reported to the Electricity Committee and made a number of suggestions. He explains that over £20,000 of the estimated revenue expenditure for the year is of a capital nature, "and a portion of the item headed loan charges is in payment of interest on borrowed capital." It is contended that if the undertaking were owned by a company well over £45,000 would be termed "profit" available for dividends to shareholders. He reviews a number of items of expenditure and shows that it is not possible to recommend any alteration. He is not in favour of transferring expenditure on short-lived plant (less than seven years) from revenue to capital account although this would enable the revenue account to be balanced. Mr. Johnson is of the opinion that a general increase or individual increases in charges would have an adverse effect upon development, but if the Council insists on securing an increased income he suggests a number of possible tariff revisions. The proposals involve the cancellation of two tariffs said to be obsolete and of the special rate for contractors' showrooms, and increases in lighting flat rates, contract rate, public lighting charges and a kW water-heating charge.

SUPPLY TO WATER WORKS.—The supply of electricity to the Shoeburyness waterworks for the purpose of operating a new plant to be installed there and also for lighting has been considered by the Electricity Committee, which has informed the Gas and Water Committee that provided it undertakes to use or pay for a minimum of 200,000 kWh per annum, the price for electricity for power will be ½d. per kWh. The Electricity Committee is to provide the necessary mains and switchgear.

Stafford.—SUB-STATION.—The Electricity Committee proposes to erect sub-stations in Newport Road at an estimated cost of £2,914, and Weaping Cross at a cost of £3,130.

Stanhope (Co. Durham).—EXTENSION.—The Parish Council has received an estimate from the North-Eastern Electric Supply Co., Ltd., for supplying electricity to houses at High Engine, and has decided to ask the company to reconsider the estimate on the grounds that it is excessive.

Stoke-on-Trent.—DISTRIBUTION SCHEMES.—A supply of electricity is to be afforded to an electric kiln at the works of the Paragon China Co., Longton, and a sum of £400 is to be spent on meeting the additional load at the Acreswood Lane Works, Burslem, of Wilkinson Bros., Ltd. A further proposal relates to the provision of a supply to 178 houses at Meir. The Electricity Committee has decided to apply for permission to borrow £89,000, the estimated cost of 33- and 6.6-kV feeders, transformers and switchgear for a high-voltage supply in the northern area of the city. An additional 400-kVA transformer and switchgear are to be installed at the Porthill substation at a cost of £900.

LIGHTING SCHEME.—The Electricity Committee has instructed the engineer to arrange for the provision of high-power street lighting in Wolstanton on the terms arranged with the Newcastle-under-Lyme Corporation.

Swansea.—REPORT ADOPTED.—The Borough Council last week adopted the final report of Mr. John Bruce, the consultant combustion engineer engaged to report on the working of the Tir John power station, and it was revealed that the recommendations involved an expenditure of between £309,000 and £340,000 and included the provision of two new boilers to cost about £100,000 each, which will double the steaming capacity and allow of the installation of additional turbines. The chairman of the Special Investigation Committee said that the scrapping of the gas-washing plant to the value of £75,000 and the substitution of plant costing from £84,000 to £110,000 was a matter of grave concern. The Central Electricity Board, however, expressed the opinion that Mr. Bruce's estimate of the additional income which would accrue as a result, namely, £12,000 per annum, was an extremely economical estimate and the Board believed that the estimated saving would more likely be nearer £25,000.

West Ashford.—ELECTRICITY ONLY IN COUNCIL HOUSES.—The Rural District Council has decided to install electricity, but not gas, in new Council houses in the district.

Whitby.—EXTENSION.—The Rural District Council has approved the extension of overhead electric lines to houses at Staithes and Grosmont by the North-Eastern Electric Supply Co., Ltd.

Wolverhampton.—E.H.V. INTERCONNECTION.—Permission has been granted to the Cannock Urban District Council to provide an interconnection between the extra high voltage systems of the Cannock undertaking and the Walsall undertaking, such interconnection to be used only during a period of failure of supply of the Wolverhampton to Cannock main.

EXTENSION.—The Electricity Committee is to erect a substation in Cronkall Lane at a cost of £1,366, and also provide a supply to Muchall Manor estate at an estimated cost of £4,751.

ELECTRIC LIGHTING REPLACES GAS.—The Electricity Committee is to replace gas lighting in the Walsall Street area by electricity at a cost of £514 and install street lighting on the Muchall Manor estate at a cost of £423.

Overseas

Australia.—DISCHARGE LIGHTING IN PRINTING WORKS.—Low-pressure mercury vapour electric-discharge lighting has been introduced in the composing room of the *Advertiser*, Adelaide, with considerable success. The new lamps give an illumination which is well diffused and soft, and operatives speak in high terms of the improvement.

Belgium.—STATE CONTROL UNDER CONSIDERATION.—The Ministry for Home Affairs is examining the question of State control of the private electricity supply industry and has prepared a report on the matter.

Czechoslovakia.—EXPANSION IN WESTERN MORAVIA.—Plans for a programme of construction which will require the expenditure of about 40,000,000 Czech crowns have been approved by the West Moravian Electric Co., which intends to use about 22,000,000 crowns on the extension of generating capacity. The energy which will be produced by the new plants will serve mostly for the development of heavy industries in Moravia and Silesia, but it is expected that Bohemia will also benefit by the increased production capacity.

Eire.—SHANNON SCHEME COMPENSATION.—The Electricity Supply Board has just made what is stated to be its final award

to the Abbey Guild of Fishermen of the Shannon. Three years ago the E.S.B. began negotiations, and some time ago it was intimated that the fishery had been acquired for the sum of £40,000, plus £4,000 for loss of livelihood. The compensation has been given to 54 of the 68 claimants. The remaining applicants propose making further representations.

Estonia.—TEN-YEAR ELECTRIFICATION PLAN.—A special Power Committee appointed by the Estonian Government recently submitted a ten-year electrification scheme which provides that by 1947 at least 65 per cent. of the total population will be able to obtain an electricity supply. During the first five years it is proposed to build 400 small power plants and to construct 2,000 km. of high-voltage transmission lines, while in the course of the second period a further 200 small power works and 1,000 km. of transmission lines are to be provided.

Federated Malay States.—ROAD LIGHTING AT IPOH.—A new street-lighting installation recently completed at Tambun Road, Ipoh, Perak, employs forty-six Wardle No. 4102 fittings each with a 150-W "Philora" sodium electric-discharge lamp. The fittings are centrally suspended at a height between 23 ft. and 25 ft., the spacing varying from 150 ft. to 170 ft. Wm. Jacks & Co. (Malaya), Ltd., of Singapore, were the contractors for the scheme.

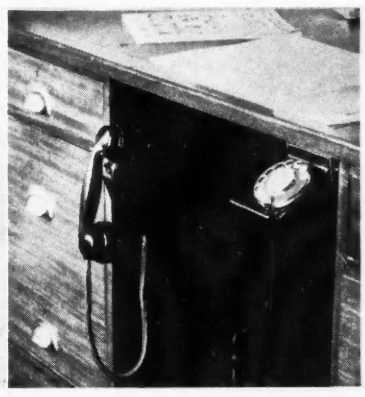
France.—TAX ON ELECTRICITY DISTRIBUTION MAINS.—Under an Order recently issued by the French Ministry of Public Works an annual tax of 30 francs per km. is to be imposed on distribution mains under Government supervision, and of 15 francs per km. on those subject to municipal control. In the case of distribution lines set up with State financial aid the tax is reduced to 10 and 5 francs per km. respectively.

India.—BIHAR GRID SCHEME.—Mr. K. P. Sinha, special officer appointed by the Bihar Government to advise it on matters of electricity, has submitted his report which is understood to contain a complete scheme for the proposed electrification of the province. The scheme covers the whole of South Bihar, including the mica mining areas. For North Bihar, he is stated to have suggested that the Nepal Government should be asked whether it would agree to harnessing a suitable waterfall, but if political considerations are found to stand in the way, one thermal station may serve the whole of North Bihar. The scheme is estimated to involve an initial expenditure of Rs. 21,600,000, rising to Rs. 26,900,000 in the fifth year. To establish authoritatively the feasibility of the scheme, Mr. Sinha has suggested an examination of the proposals by five experts.

Traction

Belgium.—INTER-URBAN MILEAGE.—During 1937 the 27-mile Brussels-Antwerp electrified section was served by 47,174 trains. This service was operated by twelve four-car multiple-unit trains which covered an average of 108,000 miles each. The number of trains run was nine per cent. greater than in the previous year.

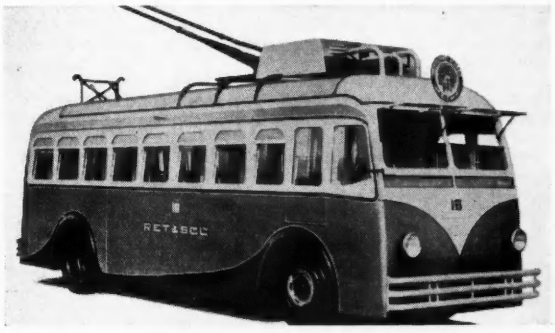
Burma.—TROLLEY-BUSES FOR RANGOON.—The trolley-bus



illustrated, of which thirty are being supplied by Ransomes, Sims & Jefferies, Ltd., is equipped with Crompton-West control gear and is specially designed for the conditions peculiar to the district. In Rangoon the streets are narrow and most of the traffic consists of hand and bullock carts; an essential feature, therefore, of these trolley-buses is their ability to negotiate the streets at a low speed. They are driven by Ransomes 35-h.p. motors and have a maximum speed of 27 m.p.h. The control equipment is arranged for regulated series field and the layout is such as to provide for easy inspection and maintenance. Rheostatic braking is provided and regulated by means of a patent Ransomes speed control switch. The present order of thirty buses follows an initial order for eighteen vehicles.

Europe.—RAILWAY ELECTRIFICATION COMPARISONS.—Figures concerning the extent of electrification of railway lines in Europe published in France indicate that Italy now holds the first place with 5,100 km. of electrified lines. Sweden comes second with 3,350 km. Germany (including Austria) has 3,200 km. of railways electrified, while France has 3,100 km. Switzerland, with 2,400 km., has the greatest density. The length of electrified railways in England is given as 1,150 km.

London.—TUBES CLOSED.—Sections of the Bakerloo and Northern underground railway lines were closed as from Tuesday night for "urgent structural works." The effect is that



One of thirty trolley-buses which have been ordered from Ransomes, Sims & Jefferies for service in Rangoon

there are no services between Piccadilly Circus and Elephant & Castle (Bakerloo Line) and Strand and Kennington (Northern line). The stations affected are Trafalgar Square, Charing Cross, Waterloo, Kennington (Charing Cross side), Lambeth North and Elephant & Castle.

South Shields.—TROLLEY-BUS EXTENSIONS.—Approval has been given to a five years' plan prepared by Mr. H. J. Troughton (transport manager) for trolley- and motor-bus extensions.

Communications

Great Britain.—CHART OF REVISED RADIO FREQUENCY ALLOCATIONS.—At the 1938 International Telecommunications Conference at Cairo important changes were made in the frequencies allotted to the various radio services. These changes are of great interest to all connected with radio, but up to the moment it has only been possible to obtain information by extracting it from complicated tables in the official documents. Standard Telephones and Cables, Ltd., has therefore presented this information in the form of a chart. Apart from its value as an immediate record of the changes made at Cairo, the chart should serve a useful purpose when frequency allocations are reconsidered by the C.C.I. at Stockholm in 1940 and by the International Telecommunications Conference at Rome in 1942.

NEW TELEPHONES.—Two new telephone models of the hand-microphone type are being introduced. The first is intended for use where a telephone and bell combined is the most suitable type of instrument. It consists of the hand-set portion of the existing type of hand-microphone resting on a newly-designed base which contains the bell, and also incorporates a tray for a notepad. For this model (in black) the standard hand-microphone charge, a single payment of 5s., will be made. It will be available to the public from October 1st. When more than ten hand-microphones, including this new combined set, are rented under one agreement in place of existing instruments the charges will be reduced in accordance with a sliding scale. The second model has been specially designed to meet the demand for an arrangement of the apparatus which will leave the top of a desk entirely free. The new model will be hung in a convenient position in the kneehole of the desk, and in areas where the automatic system has been installed the dial will be fitted in a suitable sliding bracket. An annual charge of 10s. will be made for this special model. It is anticipated that supplies will be available to the public in the New Year.

The two new telephone instruments

The Postmaster-General also announces that on October 1st a new scale of charges will be introduced for the installation and removal of extension telephones.

RADIO RELAYS.—It is understood that the Radio Manufacturers Association and the Relay Services Association have approved a common policy to oppose the Government proposals to nationalise the radio relay industry. Renewal of licences to operate radio relay undertakings for a further seven years is confidently anticipated, but it is considered very likely that a number of new conditions will be imposed.

Personal and Social

Information regarding new appointments and other matters of interest for this page are welcomed

THE directors of the Southern Railway have appointed **Mr. A. Raworth** (electrical engineer for new works) as chief electrical engineer to the company as from October 1st. Hitherto, the electrical engineering work of the Southern Railway has been controlled jointly by Mr. Raworth and **Mr. H. Jones**, Mr. Raworth being responsible for all new works, and Mr. Jones for the actual operation of the electrical equipment, staffing and running of trains, &c. Mr. Jones retires on September 30th, and from October 1st the whole of the work connected with the electrical department of the company will be controlled by Mr. Raworth.

Mr. Raworth is a son of the late Mr. J. S. Raworth, M.Inst.C.E. After being educated at St. Aubyn's, Lowestoft, and Dulwich College, he served an apprenticeship with Browett, Lindley & Co., Ltd., and the Brush Electrical Engineering Co., Ltd. For nine years, from 1903 to 1912, he acted as assistant to his father, and in March, 1912, was appointed chief assistant to the electrical engineer of the London and South Western Railway. In October, 1915, he joined the Royal Naval Air Service, and was commissioned as lieutenant, R.N.V.R. In March, 1918, he was appointed electrical engineer to the South Eastern & Chatham Railway and in

[*Elliott & Fry*

Mr. H. Jones **Mr. A. Raworth**

1920 he gave evidence for the railway company before the Electrification of Railways Advisory Committee, and in the same year was appointed chairman of the General Manager's Committee on Suburban Traffic Operation. After the amalgamation, Mr. Raworth was responsible to Sir Herbert Walker for the whole of the electrification of the eastern section suburban lines of the Southern Railway. From December, 1922, to June, 1925, he also acted as engineer to the South-Eastern & Chatham Construction & Power Co., Ltd. In July, 1925, he was appointed electrical engineer for new works to the Southern Railway, and in that capacity has been responsible for the whole of the new extensions of electrification, the major schemes being London to Brighton, London to Eastbourne, Bexhill and Hastings, London to Portsmouth *via* Woking, and London to Bognor, Littlehampton and Portsmouth *via* Horsham.

Mr. Herbert Jones was appointed chief assistant to the Waterloo and City Railway in 1898, and afterwards was appointed electrical engineer of the London and South Western Railway. After studying developments in America and elsewhere, he submitted a scheme for the electrification of the London and South Western Railway suburban lines, which in December, 1912, was adopted. In 1923, Mr. Jones was appointed electrical engineer of the Southern Railway.

Mr. R. M. Charley, M.C., B.Sc., M.I.E.E., Mem.A.I.E.E., the author of the article on "On-Load Tap-Changing" (page 446), has been engaged in the transformer industry throughout his business life, except for a period of four years during the war when he was a pilot in the Royal Flying Corps and Royal Air Force. After taking the College Apprenticeship Course with the British Westinghouse Co., Ltd., Trafford Park, Manchester, he spent about two years before and again after the war in the transformer department of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., U.S.A. In 1922 he joined the English Electric Co., Ltd., and now holds the position of sales manager of the transformer department.

Mr. R. M. Charley

A football match was played on September 21st between the staff and works of Ismay Cables, Ltd. **Mrs. Hall**, the wife of the managing director, kicked off, and the game was witnessed by an enthusiastic crowd, and after an evenly contested match the staff was victorious by the narrow margin of 3 goals to 2.

Mr. C. Hayes, who recently joined Charles White (London), Ltd., has been appointed sales manager and will assist Mr. C. White, managing director, in the further development of this wholesale electrical supplies business. Mr. Hayes was with J. H. Tucker & Co., Ltd., at their London office during the period 1934-1938. He spent nearly three years in Toronto, Canada, representing the Canadian Westinghouse Co.'s interests in domestic appliance and refrigeration sales, and prior to this was engaged from 1912-1930 (including six years' war service) in various duties, including chief correspondent and charge of the estimating and sales department of the Metropolitan-Vickers Electrical Co., Ltd., and British Westinghouse Electric & Manufacturing Co., Ltd., London Supply Department. His earliest electrical days, from 1907 to 1912, were spent with George Braulik, with which business Mr. Charles White was also connected.

Mr. C. Hayes

Mr. A. Kershaw, Assoc.I.E.E., of the technical staff of the Butler Machine Tool Co., Ltd., has been appointed to the new post of assistant secretary-administration of the Institute of Welding. Educated at Dewsbury Wheelwright Grammar School and Leeds University, with early training in colliery, by-product and chemical engineering, Mr. Kershaw served with the Yorkshire Regiment and Royal Flying Corps in the war. He was responsible for the development of the Butler forced-field planer drive and electric feed and the introduction of welded fabrication to many special machine tool applications, and has been hon. secretary of the Leeds and District branch of the Institute for three years. Mr. Kershaw will take up his duties on October 1st.

A presentation took place on September 19th when **Mr. G. N. Cadbury**, managing director of E.M.B. Co., Ltd., received an illuminated address in album form from his co-directors, staff and workpeople, on completing twenty-five years with the company. All the employés, numbering over 300, subscribed to the gift, which was presented by Mr. J. Armstrong, one of the oldest workmen. Mrs. Cadbury was also included, the gift in her case taking the form of a gold pencil. The company was formed in 1908 as the Electro-Mechanical Brake Co., Ltd., and Mr. G. N. Cadbury became a director in 1913, being joined at a later date by his two brothers, Mr. L. J. Cadbury (chairman of E.M.B.) and Major E. Cadbury (director), sons of the founder of the Bourneville chocolate factory. Mr. L. A. Catlin (director and general manager) reviewed briefly the history of the company, and said that the change in public taste in favour of buses involved a change of policy, and they hoped eventually to replace the tramcar output with machine tools and electrical control gear. A good start had already been made. Mr. Cadbury announced that gifts would be presented to eight employés who had been with the company for twenty-five years, and Mrs. Cadbury handed gold watches to each of these employés.

Mr. R. Henderson Tate is leaving the staff of the British Electrical & Allied Manufacturers' Association to-day (Friday) to take up a post in the sales organisation of Sulzer Brothers (London), Ltd.

Finals of the golf competition held by the Electrical Association for Women were played off on Wednesday morning at the Croham Hurst Golf Club, Croydon. At the subsequent luncheon celebrating what is believed to be the first time a trophy has been played for by a women's association, a William IV silver bowl, presented by Lady Hughman, was handed to the winner (with 76), **Mrs. B. H. Leeson** (Newcastle-on-Tyne) by Sir Montague Hughman, chairman of W. T. Henley's Telegraph Works Co., Ltd. As a permanent memento the winner also received an engraved silver spoon. The runner-up (with 77) was **Mrs. Pardew** (Liverpool), and the best scratch score (97) was made by **Mrs. Warner** (Reading). Sir Montague also thanked Mrs. Rendel-Baker (Croydon) for providing facilities and hospitality in connection with the event, and for having acted in place of Mrs. A. C. Cramb during her illness. A bouquet was presented to Lady Hughman by Mrs. V. Burnand (hon. sec. Golf Club Committee). Miss C. Haslett (director, E.A.W.) stated that the Association was prepared to give its wholehearted support to measures officially devised to meet the national emergency.

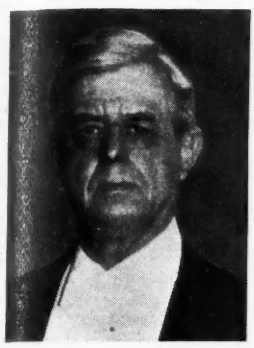
Mr. A. S. E. Ackermann, B.Sc. (Eng.) has removed to

Parliament Mansions (by 19, Victoria Street), Westminster, S.W.1 (telephone: Abbey 7244).

The Henley bowling competitions are almost completed. The singles championship for the Sir Montague Hughman cup was won by **Mr. J. S. Simmons**, who beat **Mr. J. Lapthorne**, and in the pairs championship for the W. F. Bishop cup Messrs. Lapthorne and Beal beat Messrs. Simmons and Parsons. The pairs handicap for the directors' woods—the finalists for which are Messrs. Moore and Beal v. Messrs. Bettley and Roberts—remains to be decided.

Obituary

Sir Philip Dawson.—It is with deep regret that we have to record the death of Sir Philip Dawson, M.P., which occurred on September 24th in a nursing home in Berlin at the age of seventy-one. Sir Philip's interests in the electrical industry were wide and varied, and his work in connection with railway electrification, both in this country and abroad, marked him as an electrical engineer of international standing. Born in Paris, he was privately educated and passed through the Belgian Government school of engineers at Ghent. He graduated as "ingénieur civil," and then entered the Montefiore Electrotechnical College attached to the University of Liége. In 1894 he went to the United States and Canada, making a study of electric traction and power transmission work, and the following year he travelled all through Europe on a similar mission. The London, Brighton & South Coast Railway appointed him consulting engineer in connection with the electrification of its lines in 1901, and the first of this company's suburban lines from London Bridge to Victoria was operated electrically in 1910. The success of this scheme was followed by the electrification of the whole of the suburban system, the original overhead single-phase system being changed over to d.c. third-rail with a view to compliance with the B.O.T. standard, and subsequently, the electrification of the line to Brighton was carried out. This has since been followed by extensive electrification schemes by the Southern Railway. Sir Philip joined Kincaid, Waller & Manville, consulting engineers, in partnership, in 1901, and in that capacity he came into close touch with dock, harbour, electric traction and power developments in the British Isles, in the Empire, and on the Continent; he was an accomplished linguist. As a director of Johnson & Phillips, Ltd., and a number of electricity supply companies, he was keenly interested in electricity supply and distribution problems, and in later years was a strong advocate of domestic electrification. He was the author of many works, mainly on electric traction, including "Electric Tramways and Railways" (1897), "The Engineering and Electric Traction Pocket Book," and "Electric Traction and Railways" (1909). He was also the author of numerous papers on electrical subjects which he read before British, American and Continental societies, and he contributed a number of articles to the ELECTRICAL REVIEW. After the war he was a member of the Disposals Board of the Ministry of Munitions. He also served on the Railway Electrification Advisory Committee of the Ministry of Transport and the Water Power Resources Committee of the Board of Trade. He was appointed vice-president of the Belgian Royal Commission which investigated and reported on the electrification of the State Railways and on the unification of the Belgian electric power supply. Sir Philip was a member of the Institutions of Civil, Mechanical and Electrical Engineers, and last year became the president of the Institute of Fuel. He was Conservative M.P. for West Lewisham, S.E., and was knighted in 1920.



[Elec. Rev. photo.
The late Sir Philip Dawson

Mr. C. Skipsey, who retired at the end of the last year from the position of secretary of the North-Eastern Electric Supply Co., Ltd., died on September 23rd, at his home at The Oval, Benton, at the age of sixty-six. He joined the company in 1899, and in 1907 left to become secretary of Cleveland & Durham Electric Power, Ltd., at Middlesbrough. Mr. Skipsey returned to Newcastle in 1922 as joint secretary of the Newcastle Electric Supply Co. and its associated companies, later acting as secretary after their amalgamation. He was a fellow of the Chartered Institute of Secretaries. Mr. Skipsey leaves a widow, a son and a daughter.

Mr. J. Orringe.—With the death of Mr. Joseph Orringe, A.M.I.E.E., which occurred on September 24th at the age of sixty-one, the Electrical Contractors' Association has lost one of its leading personalities. He was twice president of the Association and was one of the founders of the Leicester and County Electrical Club, of which he was first chairman, second president, and a life vice-president. Mr. Orringe was senior partner in the electrical engineering firm of Gent, Hurley & Orringe, of Leicester. He leaves a widow, four sons, and three daughters.

[Elec. Rev. photo.
The late Mr. J. Orringe

Lord Marks.—The death is announced of Lord Marks, consulting engineer and patent expert, and senior partner of the firm of Marks & Clerk, which occurred on September 24th at Bournemouth at the age of eighty. Lord Marks began practice as a consulting engineer in 1887, and he designed and carried out many important civil engineering works and mechanical, hydraulic, and electrical installations. He was also the author of a number of works on hydraulic power engineering, steam generation, patents and inventions. He was elevated to the peerage in 1929.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Freed-Eisemann Radio & Television, Ltd.—Private company. Registered September 19th. Capital, £100. Objects: To carry on the business of manufacturers of, agents for and dealers in wireless, magnetic, galvanic, and electrical goods, appliances and apparatus, television and talking film apparatus, heating and ventilating apparatus, refrigerators, &c. The directors are: I. Weiner, M. Weiner, and H. Weiner, all of 53, Goldhurst Terrace, N.W.6. Secretary: H. Weiner. Registered office: 53, Farringdon Road, E.C.1.

Wembley Electrical Appliances, Ltd.—Private company. Registered September 21st. Capital, £6,000. Objects: To acquire part of the undertaking and assets of B.T.P. Equipment, Ltd., and to carry on the business of manufacturers of and dealers in wireless, telephone, television, heating and electrical apparatus, &c. The directors are: B. A. A. Thomas, Olde Barn, Addington, Surrey, M. R. Cahill, 8, Forty Lane, Wembley, Middlesex, and F. Lindgren, C.A., 4, Old Rectory Gardens, Edgware, Middlesex. Registered office: 4, Clements Inn, W.C.2.

Lees & Jackson, Ltd.—Private company. Registered September 19th. Capital, £1,500. Objects: To acquire the business of radio dealers carried on by H. M. Lees and J. D. Jackson at 68, Iffley Road, W.6, 92, Askew Road, W.12, and 108, Blythe Road, W.14. The first directors are: H. M. Lees, 51, Furham Fields, Hatch End, Middlesex, and three others. Solicitors: L. O. Glenister & Sons, 20-22, King Street, W.6.

R. Hoe & Co., Ltd.—Private company. Registered September 21st. Nominal capital, £100. Objects: To take over an agreement dated July 15th, 1938, between R. Hoe & Co., Ltd., and R. W. Crabtree & Sons, Ltd., for the purchase by the latter company of the undertaking and assets of R. Hoe & Co., Ltd.; to adopt an agreement with R. W. Crabtree & Sons, Ltd.; and to carry on the business of electrical, manufacturing, mechanical, motor, hydraulic and general engineers, &c. The subscribers are: G. Conrad, 103, Phyllis Avenue, New Malden, and A. T. Pelling, 107, Vale Crescent, Kingston Vale, Surrey. Registered office: 109, Borough Road, S.E.1.

United Relay Exchanges, Ltd.—Private company. Registered September 19th. Nominal capital, £500. Objects: To establish and develop broadcast relay services for the relaying of wireless broadcast programmes of any kind, &c. The directors are: L. C. Field, "Cairnsmore," Streat (director of Southern Relay Service, Ltd.), R. R. Goding, 289, Roman Road, E.3 (director of Wireless-on-Tap, Ltd.), H. Roughton, 59a, Albert Street, Rugby (director of Midland Radio Relay Services, Ltd.), Wm. T. C. Smeathers, High Street, Hardingstone, Northants (director of Northampton Wireless Relay, Ltd.), H. P. Taylor, 24, Rockingham Road, Kettering, O. W. S. Watson, Montrose Court Hotel, S.W.4 (director of Metropolitan Relays, Ltd.), and S. A. Wilshere, 3, Union Street, Dudley (director of Dudley Radio Relay Service, Ltd.). Registered office: St. Paul's House, 61/63, St. Paul's Churchyard, E.C.4.

Shearman Electrical & Engineering Co., Ltd.—Private company. Registered September 21st. Capital, £1,000. Objects: To carry on the business of manufacturers of and dealers in electrical and mechanical goods and appliances. The permanent directors are: E. Boden, Tilehurst, Shepherd's Way, Rickmansworth, Herts, and H. C. Shearman, 14, Ashley Mansions, Victoria, S.W.1. Registered office: 601-2, Grand Buildings, Trafalgar Square, W.C.2.

Byron Industries, Ltd.—Private company. Registered September 22nd. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in wireless transmitting and receiving sets, electrical goods and appliances, &c. N. Wilson, 5, Beechfield Street, Manchester, 8, is the first director. Registered office: 29, Bootle Street, Manchester.

Walter Patterson, Ltd.—Private company. Registered September 22nd. Capital, £2,000. Objects: To acquire the business now carried on at 59, Fleet Street, Liverpool, as "Walter Patterson," and to carry on the business of wholesale manufac-

turers and importers and exports of and dealers in wireless telephones and wireless telephonic and telegraphic apparatus, &c. The permanent directors are: W. Patterson (managing director), and E. Patterson, both of 4, Midlothian Drive, Great Crosby, Liverpool. Registered office: 59, Fleet Street, Liverpool.

A. E. Butterfield & Co., Ltd.—Private company. Registered September 23rd. Capital, £1,000. Objects: To acquire the business of electrical contractors and engineers heretofore carried on by A. E. Butterfield and N. France at 18, Monton Road, Eccles, as A. E. Butterfield & Co. The permanent directors are: N. France, 18, Castleway, Salford, 6; Alice E. Butterfield, 36, Langworthy Road South, Salford, 5; and R. J. Woodcock, 293, Langworthy Road, Salford, 6. Registered office: 18, Monton Road, Eccles, Lancs.

Frank Heaver, Ltd.—Private company. Registered September 23rd. Capital, £1,000. Objects: To carry on the business of electrical and mechanical engineers, radio engineers, electricians, &c. E. F. Heaver, 37, Circle Gardens, Merton Park, S.W.19, is permanent governing director and chairman. Registered office: Bush House, Aldwych, W.C.2.

Calair Engineers, Ltd.—Private company. Registered September 23rd. Capital, £2,000. Objects: To acquire an option to purchase, manufacture and sell convectors, heater batteries and other heating apparatus, and to adopt an agreement with Midland Metal Diecastings, Ltd. The directors are: D. H. Skermer, 2, Aldersgate Road, Stockport; and J. Callaghan, 14, Buckley Avenue, Gorton, Manchester, 18. Secretary: Douglas H. Skermer. Registered office: Terminal House, Grosvenor Gardens, S.W.1.

Returns of Electrical Companies

Wickford and District Electricity Supply Co., Ltd.—Capital, £30,000 in 1,500 7 per cent. preference and 28,500 ordinary shares of £1. Return dated March 22nd (filed August 11th), 1938. 1,500 preference and 16,500 ordinary shares taken up. £17,995 paid on 1,500 preference and 16,495 ordinary shares. £5 considered as paid on 5 ordinary shares. Mortgages and charges, nil.

Griff Batteries, Ltd.—Capital, £3,500 in 1,000 preference shares of £1 and 10,000 ordinary shares of 5s. Return dated May 19th (filed June 30th), 1938. 752 preference and 10,000 ordinary shares taken up. £1,252 paid on 752 preference and 2,000 ordinary shares. £2,000 considered as paid on 8,000 ordinary shares. Mortgages and charges, nil.

Settle and District Electricity Co., Ltd.—Capital, £100,000 in £1 shares. Return dated May 16th, 1938. 75,000 shares taken up. £75,000 paid. Mortgages and charges, nil.

Venreco, Ltd.—Capital, £16,000 in 4,000 10 per cent. cumulative preference, 8,000 7½ per cent. second non-cumulative preference and 4,000 ordinary shares of £1. Return dated July 6th, 1938. 4,000 preference, 4,450 second preference and 4,000 ordinary shares taken up. £8,452 paid on 4,000 preference, 4,450 second preference and 2 ordinary shares. £3,998 considered as paid on 3,998 ordinary shares. Mortgages and charges, nil.

Austin Walters & Son, Ltd.—Capital, £3,000 in £1 shares. Return dated June 15th, 1938. 1,802 shares taken up. £802 paid, £1,000 considered as paid. Mortgages and charges nil.

Ewell Court Electrical, Ltd.—Capital, £2,000 in £1 shares. Return dated June 7th, 1938. 1,510 shares taken up. £10 paid, £1,500 considered as paid. Mortgages and charges nil.

Morley Electrical Engineering Co., Ltd.—Capital, £5,000 in £1 shares. Return dated June 23rd, 1938. All shares taken up. £3,980 paid, £1,020 considered as paid. Mortgages and charges: £1,000.

Chamberlain & Hookham, Ltd.—Capital, £100,000 in 10,500 ordinary and 9,500 preference shares of £5. Return dated July 5th, 1938. 10,100 ordinary and 8,000 preference shares taken up. £36,990 paid on 100 ordinary and 7,298 preference shares, £53,510 considered as paid on 10,000 ordinary and 702 preference shares. Mortgages and charges nil.

C. J. Bartley & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated July 4th, 1938. 990 shares taken up. £240 paid, £750 considered as paid. Mortgages and charges nil.

Boardley & Roberts, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated September 10th, 1938, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Morphy-Richards, Ltd.—Charge on freehold lands and hereditaments at St. Mary Cray, Kent, and an insurance policy for £4,000, dated September 6th, 1938, to secure £1,000 and further advances not exceeding therewith £4,000. Holder: H. Best, Bromley Hill Court, Bromley.

City Notes

The Brush Electrical Engineering Co., Ltd., on Wednesday last offered to its stockholders at par £150,000 new ordinary shares, the proceeds of which are to be used for financing further developments and improvements at the company's Loughborough works. The offer will remain open for seven days. Successful applicants for the new shares will receive option certificates to bearer, valid until September 30th, 1943, and conferring the right to subscribe at par for further ordinary shares on the basis of one such share for every three shares of the present issue allotted. Application is being made to the London Stock Exchange for permission to deal in these option certificates, as well as in the new ordinary capital. In announcing the issue the directors state that the company's turnover this year has been well in excess of the corresponding figure last year, all departments being well supplied with orders, which at the close of last week were in excess of the corresponding figures for last year. Only a small proportion of the orders at present on hand are connected with the Government's rearmament programme, but the re-equipment of the plant, it is officially stated, will greatly increase the company's facilities for manufacturing products required for national defence. The new issue has been unwritten by R.E.D. Trust, Ltd., and their underwriting is guaranteed by Hoare & Co.

Parkinson & Cowan, Ltd., are to redeem all of their 6 per cent. first charge debenture stock on March 31st, 1939, at 105 per cent. The total outstanding is £164,400. Stockholders have the option of converting as from October 1st, 1938, into a 4½ per cent. first charge debenture stock. Holders who convert will receive in respect of the stock they surrender the equivalent amount of 4½ per cent. stock (bearing interest as from October 1st), together with a cash payment of 5 per cent. (being the premium payable on redemption) and a cash payment of 10s. 10d. per cent. (being interest at 1½ per cent. per annum, less tax, for the six months from October 1st, 1938, to March 31st, 1939).

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., has declared a final dividend on the preferred ordinary of 6 per cent., plus an interim dividend of 2 per cent., for the year to September 30th, and on the ordinary a dividend of 6 per cent., plus an interim dividend of 3 per cent., all less tax (same).

Venner Time Switches, Ltd., is paying an interim dividend of 5 per cent. (against 10 per cent.). The directors state that in view of the recession in trade since the beginning of the year and the unsettled political situation, they have thought it prudent to limit the interim dividend to the amount stated.

The Altrincham Electric Supply Co., Ltd., has announced an interim dividend of 10 per cent. (same) on the ordinary shares and 18 44/57ths per cent. (same) on the deferred shares.

The Montreal Light, Heat & Power Consolidated is paying a dividend of 37 cents for the quarter ended September 30th (same).

Murex, Ltd., has declared a final dividend of 10 per cent., together with a cash bonus of 2½ per cent., making a total distribution for the year of 20 per cent., less tax (unchanged).

Joseph Lucas, Ltd., are paying a final dividend of 12½ per cent. on the ordinary shares, making 15 per cent. for the year ended August 7th (unchanged).

Hopkinsons, Ltd., have declared an interim ordinary dividend of 2½ per cent. (unchanged).

Marconi's Wireless Telegraph Co., Ltd., is paying an interim dividend of 3½ per cent. on the ordinary shares (against 2¾ per cent.).

The Telephone & General Trust is maintaining its interim dividend at 3 per cent.

The British Thermostat Co., Ltd., has announced an interim dividend of 6¾d. per cent., less tax (same).

The Electrical Finance & Securities Co., Ltd., is maintaining its interim dividend at 5 per cent., less tax.

Ferranti, Ltd., have announced a first and final dividend of 6 per cent., less tax, for the year (same).

The Staveley Iron and Coal Co., Ltd., held its annual meeting on September 26th when Sir William B. M. Bird (chairman), who presided, in referring to the electrical side of the company's business, said that they had generated 10½ per cent. more kWh than in the previous year, and in this connection they had erected a new 9,000-kW turbo-generator, which was started up in November last. They had also set to work three new high-pressure gas-fired Stirling boilers. Their h.v. mains had been extended by nearly a mile, making a total of 10[illegible] miles. The l.v. system had been increased by 5½ miles, bringing this system up to nearly 212 miles, and the new consumers added to their books numbered 948.

Stocks and Shares

TUESDAY EVENING.

THE temptation this week in writing anything about Stock Exchange markets is to instruct the printer to exhibit a large note of interrogation from the top of the column to the bottom. The difficulty even of commenting upon markets lies in the fact that sentiment and prices change from hour to hour, though lately there has been so little upward movement that the markets have developed into something like a one way street. Dealing in most of the stocks and shares in which there is anything approaching an active market is still being carried on, though with a certain amount of difficulty. Severe falls have taken place in British Government and other securities. The newspapers say that the selling was of no great size. Actually, however, a good deal of stock has been realised and the money thus obtained has not come back to the Stock Exchange markets. Presumably it is awaiting a more favourable opportunity than the present uncertainty can be said to offer.

The market for home electricity supply shares is amongst the few which have stood up courageously to the circumstances of the time. Prices have gone back, as a matter of course, but the fall is by no means correspondent to that which has taken place in most of the other markets, including those departments more particularly devoted to investment securities. It may be well to point out that in this week's price lists, a good many of the quotations must be regarded as more or less nominal.

Gilt-edged Securities

London and Home Counties 4½ per cent. stock, with a drop of 13½ points, is the chief sufferer amongst the gilt-edged issues quoted in our lists. Probably this is due to buyers being absent to absorb stock offered by some persistent seller. The fact of Central Electricity stocks being unaltered is not to be taken as assuring a would-be seller that he could deal at the nominal quotations. London Passenger Transport "C" is down 3. Debenture stocks have given way in company with other investment securities.

On Tuesday in this week the Consol market of the Stock Exchange adopted the extremely unusual course of fixing minimum prices for British Government stocks, public boards and certain other descriptions of gilt-edged order. This meant that, under an unofficial ordinance, the dealers agreed not to do bargains under the minimum prices that they fixed. The effect is to protect quotations—and thereby lessen the risk of public anxiety—from any such severe slump as might otherwise befall the market if large lines of stock were pressed for sale "at best," when crises were afoot.

Electricity Supply Shares

About half a score of the prices in the home electricity supply group show no change on the week. Amongst the others, County of London ordinary are down 4s. 9d., Clyde Valleys 3s. 6d., and the remainder 6d. to half a crown. Shares in foreign electric lighting companies are nearly all lower. One of the principal firms of Stock Exchange jobbers in this market abandoned, temporarily, the printing of a daily price list, owing to the difficulty of presenting actual, as distinct from nominal, quotations. Business in this department became increasingly a matter of negotiation; the ordinary process of price-making has been practically impossible to maintain in the face of the present situation.

Cable and Wireless

Developments never seem to come singly for Cable and Wireless stockholders. Within the last fortnight a quartet of important announcements have been made. First came the publication of the lowest August traffic index on record, bringing this year's average to 68.3, or 12 points lower than the corresponding 1937 level. Immediately afterwards, the operating company declared an interim dividend at the same rate, 1½ per cent., as last year's. The holding company, in which the public is interested, followed suit by announcing the payment of a full half-year's dividend on the preference stock. Now comes news that Marconi's Wireless Telegraph, a subsidiary of Cable and Wireless (Holding), is increasing its interim dividend from 2¾ to 3½ per cent. The three good items against one bad were enough to help the price of the preference stock from 88½ to 89½, but the quotation fell back later to 87½. A drop of 2½ points is shown by the ordinary stock, at 37½, and Globe Telegraph ordinary shares at 28s. 9d., have shed 1/16.

Dividend Equalisation

In connection with the fall in Cable and Wireless traffics and the operating company's decision to maintain the interim dividend, it is remembered in the first place that the directors were prepared to see a falling off in receipts during the teething-time of the new Empire flat-rate scheme. A sum of £300,000 was earmarked out of last year's profits as a protection for the dividend against this expected contingency. Also, the company is relieved this year of the heavy beam rental charge. All the same, a good many people were relieved that the holding concern felt no necessity for cutting or deferring the preference dividend. This relief seems to suggest little confidence so far as the safety of last year's 4 per cent. on the ordinary stock is concerned. The Marconi dividend, however, raises hopes of assistance by way of higher investment income, although the amount actually received from the Marconi source is not a very large drop in the bucket.

News of Brush

A report is current to the effect that the works of Brush Electrical Engineering are better employed now than for many years. Orders for several of the sections are apparently coming in at an encouraging rate. This report follows news of the company's having acquired the Petter oil-engine business, which is being transferred to the Brush company's works. The latter are said to be in process of thorough reorganisation. Brush stock units remain at around their nominal value of 5s. The expected capital issue has now been announced. Stockholders are offered £150,000 of new ordinary shares at par. This offer represents the second half of the financial reconstruction scheme, of which the first part was completed earlier this year with the severe writing down of the capital.

Miscellaneous Matters

Leading shares in the industrial markets are mostly two or three shillings down since the week-end. A few hardy bargain-hunters have kept some sort of market going in the more popular issues. As representative of how matters have moved for electrical equipment shares, General Electrics, at 73s., are 3s. 6d. lower than a week ago. Associated Electricals, British Insulated and Callenders are all half a crown down. Movements in the high-priced British Electric Traction deferred stock always look more exaggerated than they actually are; but this week's drop of 150 points, to 750, is particularly noticeable. Even the same company's preferred ordinary stock, usually ranked among the safe investment issues, is 15 points down—and a nominal market at that. Until a few weeks ago, transatlantic markets were calling the tune to a large extent in London markets. Now, however, Wall Street waits on London for a lead, and is fully under the influence of European developments. The underlying bullishness, based on the revival of American business, shows itself on the smallest encouragement from the political news.

Share List of Electrical Companies

	Nom.	Dividend. Previous.	Dividend. Last.	Price Sept. 27.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	65/–	–1/6	4 12 4
City of London	1	7½	7½	31/–	–1/6	4 16 9
Clyde Valley	1	7	8	32/6	–3/6	4 18 6
County of London	1	10½	10½	41/3	–4/9	4 5 2
Edmundson's 7% Pref.	1	7	7	31/3	–9d.	4 9 6
Do. Ord.	1	9	9	25/–	–1/–	—
Elec. Dis. Yorkshire	1	9	9	42/6	—	4 4 8
Elec. Fin. and Securities	1	12½	12½	50/–	—	5 0 0
Elec. Supply Corporation	1	11	12	53/9	—	4 9 5
Lancs Light and Power	1	7½	7½	29/6	–1/–	5 1 8
Lond. Assoc. Electric	1	—	7	30/–	–9d.	4 13 4
London Electric	1	8	7	34/–	—	4 2 4
London Power Deb. Red.	Stock	5	5	101	–2½	4 19 0
Metropolitan	1	10	12	45/–	–2/6	5 6 8
Midland Counties	1	8	8	36/3	–⅛	4 8 3
Mid. Elec. Power	1	8	9	40/9	—	4 8 3
North Eastern Electric Ordinary	1	7	7	30/–	–6d.	4 13 4
Do. 7% Pref.	1	7	7	31/3	–9d.	4 9 6
Northampton	1	10	10	46/3	—	4 6 7
Notting Hill 6% pref.	10	6	6	13½	–¼	4 9 0
North Met. Elec. Ordinary	1	10	10	45/–	—	4 9 0
Do. do. 6% Pref.	1	6	6	29/–	—	4 2 9
Scottish Power	1	8	8	33/9	–2/3	4 4 8
South London	1	7	7	31/6	—	4 9 0
Victoria Falls Ord.	1	12	13½	65/–	–½	4 3 1
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	16/3	–⅛	9 4 8
Yorkshire Elec.	1	8	8	38/6	–1/6	4 3 2
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	111	—	4 10 1
Do. 1955–75	,,	5	5	114	—	4 7 9
Do. 1951–73	,,	4½	4½	108½	—	4 3 0
Do. 1963–93	,,	3½	3½	98	—	3 10 0
London Elec. Trans. Gtd.	,,	2½	2½	87½	—	2 14 4
London & Home Counties, 1955–75	,,	4½	4½	97½	–13½	4 12 4
London Passenger Transport, A	,,	4½	4½	111	–2½	4 1 1
Do. do. B	,,	5	5	109½	–8	4 11 4
Do. do. C	,,	4	4½	72½	–3	5 17 3
West Midlands Joint Elec. 1948–68	,,	5	5	111	—	4 10 1
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$160	9	9	143½	–2	6 5 5
Anglo-Am. Tel. Pref.	Stock	6	6	106	—	5 13 1
Do. Def.	,,	1½	1½	24	—	6 5 0
Cable & Wireless 5½% Pref.	,,	4½	5½	87½	–1½	6 5 9
Do. Ord.	,,	—	4	37½	–2½	10 13 4
Do. Income	,,	—	—	101½	—	3 18 8
Globe Tel. & Tel. Ord.	1	5½*	7½*	28/9	–⅛	5 4 2
Do. do. Pref.	1	6	6	26/3	—	4 11 5
Great Northern Tel.	10	20	20	40	—	5 0 0
Marconi-Marine	1	10	7½	23/9	—	6 6 4
Oriental Telephone Ord.	1	12*	12*	57/6	—	4 3 8
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	3/9	—	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. Inc. Deb.	Stock	Nil	Nil	9	–1	—
British Electric Traction Def. Ord.	,,	5	5	750	–150	—
Do. do. Pref. Ord.	,,	8	8	150	–15	5 6 8
Brazil Traction	$100	70 cts.	$1	9	–2	—
Brit. Columbia Elec. Rly, Pce.	Stock	5	5	98½	–1½	5 1 6
Mexican Light Common	$100	Nil	Nil	1	—	—
Do. do. 1st Bonds	500	5	5	17½	–5	—
West Riding	1	6½	10	32/6	—	—
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	15	15	1 1/16	—	8 17 6
Assoc. Elec. Ord.	1	10	10	33/–	–½	6 1 3
Do. Pref.	1	8	8	36/–	–1/–	4 9 0
Babcock & Wilcox	1	10	10	32/6	–3/9	6 3 1
British Aluminium Ord.	1	10	12½	46/3	–3/3	5 16 4
British Insulated Ord.	1	20	20	4½	–½	4 14 1
Brush Ord.	5/–	Nil	Nil	5/–	—	—
Callender's	1	20	20	4¾	–¼	4 11 4
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/–	12½	12½	22/6	–⅛	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	10	12½	32/6	–⅛	7 14 0
Enfield Cable Ord.	1	25	25	2½	—	—
English Electric	1	Nil	10	24/–	–5/–	8 6 8
Do. Do. Pref.	1	6½	6½	25/6	—	5 2 0
Ericsson Tel.	5/–	25	25	37/6	—	3 6 8
Ever Ready	5/–	45	35	17/–	–1/–	10 6 0
Ferranti Pref.	1	7	7	27/6	—	5 2 0
G.E.C. Pref.	1	6½	6½	31/3	–¼	4 3 4
Do. Ord.	1	17½	20	73/–	–3/6	5 9 7
Henley's	5/–	15	20	18/9	–⅛	5 6 8
Do. 4½% Pref.	1	4½	4½	22/6	—	4 0 0
India-Rubber Pref.	1	5½	5½	21/3	+6d.	5 3 6
Johnson & Phillips	1	10	12½	37/6	–9d.	6 13 4
Lancashire Dynamo	1	20	25	55/–	—	9 2 0
Siemens Ord.	1	7½	7½	21/3	–2/–	7 1 2
Telegraph Construction	£1	7½	10	2½	–¼	4 14 1

* Dividends are paid free of Income Tax.

New Patents

Electrical specifications recently published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 23, Southampton Buildings, London, W.C.2.

1936

33081. "Impedance networks for coupling electric signal circuits." A. D. Blumlein. December 2nd, 1936. (491490.)

35555. "Thermostatic electric controls." Metals & Controls Corporation. January 27th, 1936. (491390.)

35877. "Telegraph transmitters." Telefonbau und Normalzeit Akt.-Ges. December 31st, 1935. (491491.)

1937

2401. "Electric clocks." F. A. Lanfranconi and British Vacuum Cleaner & Engineering Co., Ltd. January 27th, 1937. (Cognate application 16476/37.) (491442.)

2678. "Cathode-ray tube for television." Radioakt.-Ges. D. S. Loewe. September 11th, 1936. (491443.)

2680. "Television transmitting device." Radioakt.-Ges. D. S. Loewe. October 9th, 1936. (491247.)

2696. "Short-wave radio transmitters embodying magnetron oscillators." British Thomson-Houston Co., Ltd. January 29th, 1936. (491444.)

2697. "Electric-discharge devices generating high-frequency oscillations." British Thomson-Houston Co., Ltd. January 29th, 1936. (491445.)

2710. "Means for stopping electrically driven looms in a predetermined position." Schorch-Werke Akt.-Ges. January 31st, 1936. (491248.)

2771. "Methods of and means for cooling electric machines." J. Sousedeik. February 3rd, 1936. (491316.)

2934. "Slow-motion drive for electric condensers and like tuning devices, particularly for radio receivers." General Electric Co., Ltd., and R. W. Speirs. February 1st, 1937. (491446.)

5557. "Electrical route-indicator." Compagnie du Chemin de Fer Métropolitain de Paris. February 29th, 1936. (Cognate application 5558/37.) (491378.)

6054. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd. February 29th, 1936. (491448.)

6055. "Sealed metal envelopes or containers for electrical devices, and methods of making the same." Marconi's Wireless Telegraph Co., Ltd. February 28th, 1936. (491557.)

6061. "Electric oscillation generators." H. A. M. Clark. March 1st, 1937. (491382.)

6066. "Method of generating impulses and impulse-generator." Radioakt.-Ges. D. S. Loewe. March 3rd, 1936. (Cognate application 6067/37.) (491450.)

6149. "Electro-acoustic devices." Parmeko, Ltd., and S. N. S. Mee. March 2nd, 1937. (491384.)

6196. "Controllers for inductive devices." Igranic Electric Co., Ltd. March 4th, 1936. (491500.)

6215. "Television systems." Kolster-Brandes, Ltd., and C. N. Smyth. March 2nd, 1937. (491502.)

6284. "Electrodynamic receivers of small size." E. Hausdorf. March 5th, 1936. (491509.)

6346. "Electric rectifiers." British Thomson-Houston Co., Ltd., and F. P. Whitaker. March 3rd, 1937. (491514.)

6421. "Electric storage batteries." J. Lucas, Ltd., and G. D. Spencer. March 4th, 1937. (491520.)

6579. "Grid electrode structures for electric discharge devices." M-O Valve Co., Ltd., and P. G. Forward. March 5th, 1937. (491526.)

6626. "Station-name indicators for radio receivers." Kolster-Brandes, Ltd., and K. G. Smith. March 5th, 1937. (491531.)

6627. "Means for varying the selectivity of radio receivers." Kolster-Brandes, Ltd., and K. G. Smith. March 5th, 1937. (491532.)

6628. "Arrangements for protecting the cabinets of wireless receiving-sets during transit." Kolster-Brandes, Ltd., E. A. Moy, and A. Barton. March 5th, 1937. (491533.)

7167. "Thermionic-valve amplifying circuits." Scophony, Ltd., and J. H. Jefree. March 11th, 1937. (491389.)

8074. "Photo-electric cells." Ferranti, Ltd., and J. A. Darbyshire. March 19th, 1937. (Cognate application 8075/37.) (491326.)

8215. "Sparking plugs." S. J. Frost. March 19th, 1937. (Cognate application 21701/37.) (491328.)

8758. "Artificial or imitation fuel for electric fires and the like." Berkeley & Young, Ltd., and G. L. A. Grundon. March 25th, 1937. (491329.)

10493. "Fan-cooled dynamo-electric machines." English Electric Co., Ltd., L. Roberts, and R. D. Ball. April 13th, 1937. (491260.)

11012. "Mounting of electric switches, bell-pushes, coupling sockets, and other electrical units." C. L. Arnold, R. W. Dowsett, and M.K. Electric, Ltd. April 17th, 1937. (491462.)

11542. "Tuning devices for wireless receivers." General Electric Co., Ltd., and W. H. Peters. April 22nd, 1937. (491463.)

12579. "Permanent magnets for sound-transforming." E. Hausdorf. May 3rd, 1937. (491263.)

14807. "Electric plug-and-socket switches." W. Preston. May 28th, 1937. (491399.)

17286. "Electron-discharge amplifying apparatus." C. L. Hirshman, and Metropolitan-Vickers Electrical Co., Ltd. June 21st, 1937. (491468.)

18327. "Alternating-current motors." British Thomson-Houston Co., Ltd. July 1st, 1936. (491469.)

19928. "Television apparatus for transmitting kinematographic pictures." K. Takayanagi. July 19th, 1937. (491266.)

20870. "Carrier or support for electrical circuit elements." A. H. Midgley and A. M. Midgley. July 28th, 1937. (491267.)

22502. "Fluid-operated electric switches." W. R. Hamilton and R. W. Hamilton. August 16th, 1937. (491268.)

22655. "Transformation of electric relaxation oscillations." Radioakt.-Ges. D. S. Loewe. March 28th, 1936. (Divided out of 7678/37.) (491270.)

22898. "Selecting and typing means for printing-telegraphs." Standard Telephones & Cables, Ltd. (A. H. Adams). August 20th, 1937. (491352.)

23142. "Means for determining the direction of rotation of synchronous electric motors." H. N. Walford. August 24th, 1937. (491403.)

25024. "Dynamo-electric machines." Deuta-Werke, Vorm. Deutsche Tachometerwerke Ges. September 14th, 1936. (Cognate application 25025/37.) (491404.)

26523. "Piezo-electric crystal elements." Marconi's Wireless Telegraph Co., Ltd. September 30th, 1936. (491277.)

27378. "Piezo-electric crystal apparatus." Standard Telephones & Cables, Ltd. November 25th, 1936. (491407.)

29326. "Telephone-rate recorders." Sodeco. Soc. des Compteurs de Geneve. October 31st, 1936. (491281.)

29979. "Electric wave-filter." C. Lorenz Akt.-Ges. November 3rd, 1936. (491354.)

32403. "Cathode-ray television transmitter tubes." Marconi's Wireless Telegraph Co., Ltd. December 31st, 1936. (491413.)

33370. "X-ray apparatus." British Thomson-Houston Co., Ltd. December 2nd, 1936. (491477.)

34007. "Welding fluxes and flux-coated electrodes." British Thomson-Houston Co., Ltd. December 9th, 1936. (491478.)

35039. "Transmission modifying networks for electric signalling systems." Standard Telephones & Cables, Ltd. January 2nd, 1937. (Cognate application 35040/37.) (491359.)

1938

400. "Synchronous motor drives for electric selectors." Landis & Gyr Akt.-Ges. May 13th, 1937. (491420.)

578. "Secondary electron emitting electrodes suitable for electron-disc discharge devices." Marconi's Wireless Telegraph Co., Ltd. January 30th, 1937. (491287.)

872. "Rectifier arrangements." Siemens-Schuckertwerke Akt.-Ges. January 11th, 1937. (491288.)

1186. "Magneto-electric generators." Magnetos Lucifer Soc. Anon. January 15th, 1937. (491289.)

1943. "Methods of forming insulating films on conducting surfaces, more particularly in mosaics for cathode-ray tubes." Marconi's Wireless Telegraph Co., Ltd. February 27th, 1937. (491422.)

1989. "Combined stand and holder for electric irons." E. Flaherty, and A. Whitehead (legal representative of W. Whitehead, decd.). January 21st, 1938. (491366.)

2192. "Cathode-ray television transmitter tubes." Marconi's Wireless Telegraph Co., Ltd. March 30th, 1937. (491292.)

2835. "Combined electron-discharge tubes and electron multipliers." Marconi's Wireless Telegraph Co., Ltd. January 28th, 1937. (491425.)

3805. "Apparatus for measuring high-frequency voltage." Siemens & Halske Akt.-Ges. February 11th, 1937. (491294.)

5217. "Electric ironers." British Thomson-Houston Co., Ltd. February 18th, 1937. (491429.)

5889. "Electric lamp sockets." British Thomson-Houston Co., Ltd. February 24th, 1937. (491430.)

6315. "Piezo-electric crystal mounting arrangements." Telefunken Ges. für Drahtlose Telegraphie. February 26th, 1937. (491433.)

8525. "Radio transmitting antennae." Marconi's Wireless Telegraph Co., Ltd. April 16th, 1937. (491485.)

9449. "Radio receivers employing the homodyne principle." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 30th, 1937. (491437.)

15364. "Electrically maintained balance and contact device for clocks." F. A. Lanfranconi, and British Vacuum Cleaner and Engineering Co., Ltd. January 27th, 1937. (Divided out of 491442.) (Cognate application 15365/38.) (491487.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 21st:—

My Domestic (lettering and design). No. 580097. Class 6. Electrically operated domestic labour-saving machinery.—The English Electric Co., Ltd., Queen's House, 28, Kingsway, W.C.2.

Actarc (lettering and design). No. 481976. Class 6. Welding machines and parts thereof. No. 581977. Class 13. Electrodes and filler rods of ordinary metal for use in electric arc welding.—A. Arc, Ltd., 52a, Goldhawk Road, W.12.

Westarc. No. 584931. Class 8. Electric current rectifiers (not being machines), electrical resistances, fitted electrical switchboards, electric induction coils, and electric condensers, all for use in the supply of electric current to projection arc lamps.—The Westinghouse Brake and Signal Co., Ltd., 82, York Way, Kings Cross, N.1.

Autolar. No. 586932. Class 10. Electric clocks.—Smith's English Clocks, Ltd., Cricklewood Works, Edgware Road, Cricklewood, N.W.4.

Patol. No. 584776. Class 18. Air purifying and conditioning apparatus consisting of filtering, decontaminating, heating, cooling, humidifying, drying, washing or the like elements in combination with pumps, fans or other motive means.—Joseph Poulson, 329, County Chambers, Corporation Street, Birmingham.

Invertec. No. 600003. Class 11. (Schedule IV). Standard lamps.—The Trump Electrical Mat Co., Ltd., 63, Newman Street, W.1.

Brivoid. No. 600315. Class 17 (Schedule IV). Electrical insulating materials.—British Vulcanised Fibre, Ltd., 21, Major Street, Manchester.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberdeen.—October 6th. County Council. Electrical work at the Longside housing estate. County Clerk, County Buildings, Union Terrace.

Australia.—MELBOURNE.—October 4th. Posts and Telegraphs Department. Underground cable. (T. 26684/30.)* Relays for operation on a 24-V d.c. circuit. (T. 26685/38.)*
October 25th. Outside broadcast amplifiers and equipment. (T. 26878/38.)*

VICTORIA.—October 18th. State Electricity Commission. Steel cored aluminium conductors and sleeves for twelve months. (T.Y. 26700/38.)*
November 8th. Varnished cambric and p.i. cable. (T. 27159/38.)*

Ayr.—October 3rd. County Council. Electrical work at Glencairn School, Kilmarnock, and Kilmaurs School. County architect, County Buildings.

Birmingham.—November 4th. Electric Supply Department. Construction of the main buildings for Ham Hall "B" power station. (See this issue.)

Bradford.—September 30th. Town Council. H.v. and m.v. overhead distribution lines, Egypt, Harrop Edge, &c. T. Roles, city electrical engineer, 45/53, Sunbridge Road (deposit £1 1s.).

Bristol.—October 14th. Electricity Department. One 150-kV d.c. testing equipment. (See this issue.)

Bury.—October 31st. Corporation. Electric lighting and power installation at the new Town Hall. Town Clerk, municipal Offices (deposit £2 2s.).

Cheadle and Gatley.—October 17th. Electricity Department. Extensions to 6.6-kV switchgear for the Larkhill estate substation, Adswood, Cheshire. (See this issue.)

Chester.—October 17th. County Council. Electrical installation comprising electric lighting and power services, electric lifts, tubing for internal telephones, watchmen's tell-tales, electric clocks, &c., at the new County Offices. Clerk of the County Council, County Offices, St. John's House (deposit £10).

Chile.—SANTIAGO.—September 30th. Agricultural Export Board. Two vertical elevators. (T.Y. 26715/38.)*

Coventry.—October 10th. Corporation. Pumping plant comprising two electrically driven borehole pumps, electric control equipment and all accessories. F. Smith, Town Clerk, Council House (deposit £3).

East Grinstead.—September 30th. U.D.C. A.c. and d.c. house service meters during the period ending March 31st, 1940. (September 16th.)

Egypt.—CAIRO.—October 6th. Four 25-kVA three-phase transformers. (T. 26668/38.)*

Elgin.—October 12th. Town Council. Electrical work at Deanshaugh Farmhouse. Town Clerk.

Fife.—October 4th. County Council. Electric lighting installation at St. Michael's Hospital, Leuchars. County Clerk, Cupar (deposit £1 1s.).

Folkestone.—October 4th. Corporation. Electrical wiring of ninety-two houses to be erected near Shaftesbury Avenue. (September 23rd.)

Gloucester.—Town Council. Electric meters and p.i. cables. City electrical engineer, Commercial Road.

Guernsey.—October 5th. Waterworks Department. Multi-stage centrifugal pumps, electric motors and appurtenant works at the Marais Stream and Vale Pond pumping stations. W. H. Morgan, engineer and manager (deposit £2).

India.—MADRAS.—October 19th. Electricity Department. Mettur hydro-electric scheme extensions: Sixteen miles of 33-kV 0.03 sq. in. copper single-circuit line from Chittoor to Pakala. Nineteen miles of 11-kV 0.03 sq. in. copper single-circuit line from Pakala to Chandragiri. (T. 26699/1938.)*
SIMLA.—October 4th. Indian Stores Department. 660-V cables and pot-heads for the East Indian Railway. (T. 26903/38.)*

Iran.—Ministry of Posts, Telegraphs and Telephones. Cable (47 km.). Commercial Attaché to the Imperial Iranian Legation, Ling House, 10/13, South Street, E.C.2.

Iraq.—BAGHDAD.—November 6th. Directorate General of Posts and Telegraphs. One automatic 5,000 line switchboard. (September 16th.)

Leyton.—October 17th. Corporation. Installation of electric lighting in proposed new library and lock-up shops, Harrow Green, E.11 (September 16th.)

London.—Commissioners of H.M. Works.—October 14th. Turbo-alternators and auxiliaries at Pembrey R.O.F. and Bridgend R.O.F., and switchgear, &c., for power station at Bridgend R.O.F. (September 16th.)
October 17th. Lighting protection installation at Glascoed R.O.F. (See this issue.)
October 24th. Sub-station switchgear, transformers, &c., at Bridgend R.O.F. (See this issue.)
October 19th. Electrical wiring at Bishopton R.O.F. (See this issue.)

Manchester.—October 3rd. Electricity Committee. 6,600-V and 400/230-V overhead and underground transmission system and pole sub-station equipment. (September 16th.)
October 3rd. Electricity Department. One traction battery. (September 23rd.)
October 10th. One light electrically propelled tower-ladder vehicle. (See this issue.)

Mansfield.—October 24th. Electricity Department. P.i. lead-covered cable. (See this issue.)

Newport.—October 17th. Electricity Department. One electrically driven circulating water pump, switchgear and water screening plant. (September 16th.)

New Zealand.—WELLINGTON.—November 15th. Public Works Department. Four 750-kVA units for transformer bank and spare at Tahekeroa sub-station (Arapuni—Section 615). (T. 26615/38.)*
January 17th, 1939. Outdoor and indoor cable boxes, distribution and connector boxes, &c. (T.Y. 27084/38.)*
October 6th. Posts and Telegraph Department. Conduits for lead-covered telephone cables. (T.Y. 26621/38.)*
November 30th. Telephone cable. (T.Y. 26940/38.)*
DUNEDIN.—October 31st. Electric Power and Light Department. Four 400-A circuit-breakers. (T. 26943/38.)*

AUCKLAND.—November 21st. Electric Power Board. 7,000 yd. of p.i. cable, thirty joint boxes, two-end dividing boxes, together with necessary jointing material and compound. (T.27082/38.)*

Northallerton.—October 12th. North Riding Education Committee. Installation of electric lighting and power at the new high school for girls, Richmond, Yorkshire. F. Barraclough, secretary, Education Offices, County Hall.

Northern Ireland.—BELFAST.—October 7th. Electricity Department. Reconstruction of existing 6.6-kV armourclad switchgear. (September 23rd.)

Portsmouth.—October 18th. Electricity undertaking. 33-kV p.i. lead-covered wire-armoured cable. (See this issue.)

Salford.—October 10th. Electricity Department. Materials required for the assisted wiring scheme, including lamps and shades. (See this issue.)

South Africa.—PRETORIA.—October 13th. Union Tender and Supplies Board. Motor-driven ringing generators for a.c. supply. (T. 26531/1938.)*
October 20th. One 1,000-kVA transformer. (T. 26989/38.)*
October 4th. Electric Supply Department. E.h.v. ring main units, l.v. switchgear, p.i. cables and power transformers. (T. 26757/1938.)*
October 6th. Public Works Department. Refrigerating plant and a water cooling unit for the Poison Extraction Laboratory, Onderstepoort. (T.Y. 26756/1938.)*
CAPE TOWN.—October 10th. Electricity Department. Pole mounting core type transformers. (T.Y. 26749/38.)*
October 12th. Electricity Supply Commission. One 33-kV oil-circuit-breaker and two 300-kVA and two 500-kVA transformers. (T.Y.26971/1938.)*
JOHANNESBURG.—October 24th. Railways and Harbours Administration. Superheater elements for boilers. (T. 26597/38.)*
October 13th. Public Works Department. Five electric lighting plants, together with necessary switchgear. (T.26991/38.)*
October 13th. Electricity Department. Ten 20,000/6,000-V transformers and one bank comprising three single-phase limiting reactors. (T.26996/38.)*
October 15th. City Council. High- and low-voltage p.i. power cable. (T.Y.27094/38.)*
October 19th. Circuit-breaker testing equipments. (T.Y.27090/1938.)*
PORT ELIZABETH.—October 13th. City Engineer's Department. Electric fans. (T. 26742/38.)*

Stoke-on-Trent.—November 2nd. North West Midlands J.E.A. Painting of chimney stacks, &c. Overhead transmission lines. (See this issue.)

Tunbridge Wells.—October 3rd. Corporation. Electrical installation at new Assembly Hall. (September 23rd.)

Uruguay.—MONTEVIDEO.—October 18th. State Electricity Supply and Telephones Administration. Galvanised steel cable. (T.Y. 26947/38.)*

Wakefield.—October 3rd. West Riding County Council. Electric lighting installation at extensions of Ryhill senior school. Sir J. Charles McGrath, clerk to the Council.

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*Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Croydon.—Electricity Committee. Recommended. Extension of "Mulsifyre" fire protection system (£411).—Mather & Platt.

East Sunderland.—Town Council. Accepted. Installation of an electric passenger lift in the nurses' hostel at the Municipal Hospital.—Pickerings.

London.—POPLAR.—Contracts Committee. Accepted. Heating and ventilating plant at electricity showrooms (£1,975).—G. N. Haden & Sons. Street-lighting equipment (£131).—Revo Electric Co.
HAMMERSMITH.—Electricity Committee. Recommended. Internal telephone system at the electricity offices and showrooms (£426).—Reliance Telephone Co. Two low-voltage, three-phase switchboards at the White City housing estate (£372).—W. Lucy & Co. Overhaul of two 1,000-kVA transformers for the White City housing estate (£174).—Hackbridge Electric Construction Co.

Southend.—Town Council. Accepted. Electrically driven pumping plant at the Waterworks, Shoeburyness, together with ancillary work in connection therewith.—Harland Engineering Co.

Stoke-on-Trent.—Electricity Committee. Accepted. Electrical installation at St. George's Hall (£1,028).—E. Holloway, Ltd.
Water heaters: Aidas Electrical Co.; Ferranti, Ltd.; General Electric Co., Ltd.; Heatrae, Ltd.; Simplex Electric Co.; Santon. Cookers: Carron Company; English Electric Co.; G.E.C.; Hotpoint Electrical Appliance Co.; Jackson Electric Stove Co.; Revo Electric Co.; Simplex Electric Co.; Tricity Cookers. Washboilers: Burco; Elexcel; G.E.C.; Hogan & Wardrop; Revo Electric Co.
Hospital Committee. Accepted. Electrical installation at Hospital laundry (£178).—F. Hancock.
Mental Deficiency Committee. Accepted. Electrical installation at Stallington Hall farm (£59).—F. Hancock.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Addington.—Houses (16), Ferris Avenue; Bennett & Worskett. Houses (516), Lodge Land; First National Housing Trust, Ltd.

Berkshire.—Extensions to grammar school, High Wycombe (£7,500), for the County E.C.

Bexhill-on-Sea.—Nurses' home at Bexhill Hospital; Mr. Maynard, architect.

Birmingham.—Garage and workshops, Stratford Road, Hall Green; Frank Davis, Ltd., builders, College Road, Birmingham. Six-storey factory and offices, fronting on Constitution Hill; T. Elvins & Son, builders, Soho Hill.

Blackpool.—Houses, Willow Bank Farm; Fairbrother & Hall, architects, Abingdon Street. Houses (24), Longridge Avenue and Weeton Avenue; I. Fletcher, Ltd., Weeton Avenue.

Blackwell.—Houses (104), Blackwell, Tipshelf and Glapwell sites; A. H. Elliott, engineer and surveyor, Gilcroft Chambers, Gilcroft Street, Mansfield.

Boldon (Co. DURHAM).—Houses, in connection with clearance plans; N. Hindmarsh, U.D.C. surveyor.

Bootle (LANCASHIRE).—Branch library and assembly hall, Linacre Lane; borough surveyor.

Bradford.—Buildings (£50,000), for Bradford Regional Radium Institute Committee; E. Morley, architect, Swan Arcade.

Bristol.—Omnibus garage, Winterstoke Road; H. A. Penney, architect, Whitson Street.

Chester.—School, Blacon (£11,341); E. B. J. Gould, Ltd.

Corley.—Estate development, Main Road; W. J. Buswell, 82, Fir Tree Avenue, Coventry.

Croydon.—Extensions to Elmhurst School, South Park Hill Road; G. P. Peachell. Enlargement of school (£9,000), for the E.C.

Darlington.—Houses (10), Davison Road and Salters Lane; Bussey and Armstrong, builders, Brinkburn Road. Houses (10), Harris Street and Estoril Road; W. H. Bean, builder, Weir Street. Alterations to cinema, Skinnergate, for Gaumont British Cinemas; J. L. Ross, architect, Main Street, Wishaw.

Droitwich.—Houses (70), Experimental Gardens site; for the T.C.; Towers, Wilson & Co., Wolverhampton.

Dudley.—Houses (242), Bowling Green estate; Eadie & Co. Bank and offices, Castle Street; Westminster Bank, Ltd.

Durham.—Flats (61), Milburngate, for the North-Eastern Housing Association; J. W. Green, architect, Town Hall, Durham.

Eccles.—Food factory, Monton Fields Road, Monton, for Hill and Hiley, Ltd.; William Gornall & Sons, Ltd., contractors, Gore Street, Salford.

Edinburgh.—Factory, Potterrow, for Peter Stevenson, Ltd. (£2,000); Erskine, Thomson and Glass, 36, George Street, Perth.

Essex.—Police court and station (£16,637), Epping, and school, Sible Hedingham (£33,018); county architect.

Fenton (STAFFORDSHIRE).—Houses (14), Poole Street; G. H. Wignall. Factory, near Fenton Park; Trifons, Ltd.

Garston (LANCASHIRE).—Garage buildings, for the Garston and District Co-operative Society, Ltd., 80, St. Mary's Road; Turner & Moss, Ltd., builders, King Street.

Gateshead.—Factory and storage depot, Team Valley Trading estate, for Hedley and Co., Newcastle-on-Tyne; Hadden and Hillman, contractors, Huddlestone Road, Newcastle-on-Tyne.

Glamorganshire.—School, Neath (£10,995), for the County E.C.

Glasgow.—Houses (1,000), Pennilee, and three community centres and a social centre for the Corporation; the architect, Housing Department.

Gloucester.—Technical college (£87,194), for the E.C.

Guisborough.—Extensions to factory for Guisborough Shirt and Underwear Co.; Archibald and Archibald, architects, 26, Albert Road, Middlesbrough.

Hanford (STAFFORDSHIRE).—Ice cream factory, Stoke Road; Joe & Morris.

Hanley.—Shop and offices, Piccadilly; Prudential Assurance Co., Ltd.

Huddersfield.—School, Grosvenor Road (£41,026), for the E.C.

Hyde.—Art gallery and museum buildings, Newton Lodge, Hyde Park, for the T.C.: Thomas Warrington & Sons, builders, Bennett Street.

Jarrow-on-Tyne.—Houses, Don Valley, swimming baths, Belsfield Gardens, and two schools; J. S. Weir, borough engineer.

Kenilworth.—Enlargement of Knowle Hill School (£5,000); managers.

Kettering.—Extensions to Isolation Hospital, Rockingham Road, for the Joint Hospital Board; Blackwell and Storry, architects, Gold Street Chambers.

Leicester.—Extensions to factory, Abbey Lane, for Evans Lifts, Ltd.; W. M. Sharp and Son, Ltd., builders, East Short Street.

Lincoln.—Cinema, Staunton House, Newport, Lincoln; W. J. King, architect, Piccadilly House, 16-17, Jermyn Street, London, S.W.1.

Liverpool.—Houses (27), Highfield estate, Birkenhead; H. W. Lloyd, Ltd., builders, Bebington, Liverpool. Factory, Cardwell Street, for Powell & Scholefield, Ltd.; T. Arnold Ashworth & Sons, architects, Castle Street.

Manchester.—Houses, Cudworth Road, Broomhall Road, Draycott Road and Aldersley Avenue, Blackley, for Winter Bros. (Builders), Ltd., Victoria Avenue, Blackley; Roberts, Wood and Elder, architects, 26, King Street, Manchester. Showroom, garage and filling station, Chester Road, Stretford, for Graham Bros. (Motors), Ltd., 15, Peter Street; J. H. Billings & Co., Ltd., contractors, 38, Green Lane, Ardwick. Extensions to bakery, Bank Street, Levenshulme, for Robinson & Smith, Ltd., Bank Street; J. Lee & Sons (Stockport), Ltd., contractors, 36, Shaw Heath, Stockport.

Mirfield.—Houses (45), junction of Stocks Bank and Kitson Hill Roads; P. Womersley.

Monmouthshire.—School, Blaina; Colin Jones, architect, County Hall, Newport.

Morley.—Houses (60), Wild Lane; borough engineer.

Newcastle-on-Tyne.—Houses (28), Cloverdale Gardens and Patterdale Gardens; Regal Building Co., Cloverdale Gardens. Houses (16), Etherstone Avenue, &c.; F. E. Maughan, builder, Turbinia Gardens. Children's rooms at the Welbeck Road and Victoria Libraries, for the City Council; J. F. C. Solomon, city property surveyor, Town Hall. Offices, Walker Road, for Angus and Co., Ltd.; Hetherington and Wilson, architects, County Chambers, Westgate Road.

Nottingham.—Houses and flats, Council estates; city engineer.

Peterborough.—Schools, Bishop's Road and Padholme Road, for the E.C.

Princes Risborough.—Houses (86) and shops, near Station Road; H. C. Janes, Ltd.

Rawtenstall.—Clinic, Crawshawbooth, and gymnasium at Central school; borough engineer.

Risca.—Houses (104), Gelli estate; engineer and surveyor.

Rugby.—Extensions to factory, Spring Street, for R. & W. H. Symington & Co., Ltd., Liberty Lane, Market Harborough; W. H. Adams & Sons, contractors, 35a, Regent Street, Rugby.

St. Helens.—School, for the managers, Low House Girls' school; W. Ellis, architect, Union Bank Buildings, Hardshaw Street.

Sedgley.—Houses (20), Bath Street; Brookes Bros.

Sheffield.—Premises, Lindsay Avenue, for the Brightside and Carbrook Co-operative Society, Ltd., Exchange Street. Sale-shops, Brooklands Avenue and Crimicar Lane, for Sheffield and Ecclesall Co-operative Society, Ltd., The Arcade, Ecclesall Road; W. G. Robson, Ltd., contractors, Bamforth Street.

Stockton-on-Tees.—Houses, near Newham Grange and Rudds Land, for the T.C.; A. S. Knolles, borough engineer.

Stoke-on-Trent.—Houses (16), Pool Street; G. H. Wignall. Laundry premises, offices and garages, &c., for Phœnix Steam Laundry and Dry Cleaning Works, Stone Road, Longton; R. T. Longden, 10, King Street, Newcastle, Staffordshire.

Sunderland.—Schools, Alexandra Road, North Hylton Road, and Monkwearmouth, and alterations to Monkwearmouth Central school, for the E.C.; O. H. Mark, architect, John Street, Sunderland.

Thornaby-on-Tees.—Houses (60); borough engineer.

Tredegar.—Houses (52), for the U.D.C.; E. Jones, Council Offices.

Waddon.—Two factories, Progress Way; Croydon Factory Estate, Ltd.

Wellingborough.—Drill hall, offices, mess room, &c., for Northern Command Territorial Army Association; E. Brown and Sons, Ltd., builders, Castle Street.

Whitley Bay.—Council Offices (£20,000), floral hall (£10,000), and houses; U.D.C. surveyor.

Wigan.—School, Beech Hill, for the T.C.; J. Dove, surveyor, Municipal Buildings, Library Street.

Winlaton (Co. DURHAM).—Houses (24), Holly Avenue, &c.; N. T. Barker, builder.

Wolverhampton.—Houses (58), Stafford Road; Brookes and Edwards. Houses (39), Trysull Road; Timmins & Davies.

Yorkshire.—School, Kirby Avenue, Bentley, for the West Riding E.C.; Walker & Thompson, architects, Carbon Chambers, Halgate, Doncaster. School, Mirfield; education architect, County Hall, Wakefield. School, Swinton, for the West Riding E.C.; Gribbon, Foggitt & Brown, architects, 3, Park Place, Leeds.

Progress in Sweden

MR. G. MALM, upon his recent retirement from the post of Director-General of the Swedish Waterfalls Board that he had held for ten years, reviewed the development of the water-power industry. He stated that the amount of power generated by plant owned by the State had increased from 1,500 million kWh in 1927 to approximately 2,800 million kWh last year, the aggregate capacity of the plant having simultaneously grown from 326,000 to 537,000 kW. The biggest projects during later years had been the raising of the level of Sweden's biggest lake, which is 2,150 square miles in extent, the linking up of three large State power systems through a 1,000-mile line across the country from north to south, and the establishment of mutual power exchange between the State and private power systems. Despite the depression in 1931-33, which reduced the consumption of power to very low figures, the previously adopted expansion scheme was carried out to the full extent, and this policy subsequently proved useful, because the Waterfalls Board would otherwise never have been able to meet the enormously increased demand for power, to which the industrial boom of more recent years gave rise. In 1935, when a special commission was appointed to suggest another expansion scheme, it was found that all water-power resources in Central and Middle Sweden had been exhausted as far as the State was concerned. It was then decided to harness a number of falls in North Sweden. A new scheme adopted in 1935 and subsequently amended in 1937 included the construction of a large water-power plant at Stadsforsen on the River Indal, enlargement of the Porjus hydro-electric station and the building of three new plants at Torpshammar, Sundvall and Hojum. According to recent newspaper accounts the Waterfalls Board has requested the Government to grant the equivalent of £1 million in excess of the normal expenditure in order to speed up the expansion of the water-power system.